U. S. DEPARTMENT OF AGRICULTURE
OFFICE OF EXPERIMENT STATIONS
A C TRUE, DIRECTOR

EXPERIMENT STATION RECORD

Volume XI, 1899-1900

WASHINGTON
GOVERNMENT PRINTING OFFICE
1900

U. S. DEPARTMENT OF AGRICULTURE.

Scientific Bureaus and Divisions.

Weather Bureau—Willis L. Moore, *Chief.*
Bureau of Animal Industry—D. E. Salmon, *Chief.*
Office of Plant Industry—B. T. Galloway, *Director.*
Affiliated Divisions:
Division of Vegetable Physiology and Pathology—A. F. Woods, *Chief.*
Division of Agrostology—F. Lamson-Scribner, *Agrostologist.*
Division of Pomology—G. B. Brackett, *Pomologist.*
Division of Statistics—J. Hyde, *Statistician.*
Division of Entomology—L. O. Howard, *Entomologist.*
Division of Chemistry—H. W. Wiley, *Chemist.*
Division of Botany—F. V. Coville, *Botanist.*
Division of Forestry—G. Pinchot, *Forester.*
Division of Biological Survey—C. Hart Merriam, *Chief.*
Division of Soils—M. Whitney, *Chief.*

Office of Experiment Stations—A. C. True, *Director.*

THE AGRICULTURAL EXPERIMENT STATIONS.

Alabama—*Auburn:* College Station; P. H. Mell.* *Uniontown:* Canebrake Station; H. Benton.†
Arizona—*Tucson:* R. H. Forbes.*
Arkansas—*Fayetteville:* R. L. Bennett.*
California—*Berkeley:* E. W. Hilgard.*
Colorado—*Fort Collins:* L. G. Carpenter.*
Connecticut—*New Haven:* State Station; E. H. Jenkins.* *Storrs:* Storrs Station; W. O. Atwater.*
Delaware—*Newark:* A. T. Neale.*
Florida—*Lake City:* W. F. Yocum.*
Georgia—*Experiment:* R. J. Redding.*
Idaho—*Moscow:* J. A. McLean.*
Illinois—*Urbana:* E. Davenport.*
Indiana—*Lafayette:* C. S. Plumb.*
Iowa—*Ames:* C. F. Curtiss.*
Kansas—*Manhattan:* J. T. Willard.*
Kentucky—*Lexington:* M. A. Scovell.*
Louisiana—*Audubon Park, New Orleans:* Sugar Station. *Baton Rouge:* State Station. *Calhoun:* North Louisiana Station. W. C. Stubbs.*
Maine—*Orono:* C. D. Woods.*
Maryland—*College Park:* H. J. Patterson.*
Massachusetts—*Amherst:* H. H. Goodell.*
Michigan—*Agricultural College:* C. D. Smith.*
Minnesota—*St. Anthony Park, St. Paul:* W. M. Liggett.*
Mississippi—*Agricultural College:* W. L. Hutchinson.*
Missouri—*Columbia:* H. J. Waters.*
Montana—*Bozeman:* S. Fortier.*
Nebraska—*Lincoln:* E. B. Andrews.*
Nevada—*Reno:* J. E. Stubbs.*
New Hampshire—*Durham:* C. S. Murkland.‡
New Jersey—*New Brunswick:* E. B. Voorhees.*
New Mexico—*Mesilla Park:* F. W. Sanders.*
New York—*Geneva:* State Station; W. H. Jordan.* *Ithaca:* Cornell University Station; I. P. Roberts.*
North Carolina—*Raleigh:* G. T. Winston.*
North Dakota—*Agricultural College:* J. H. Worst.*
Ohio—*Wooster:* C. E. Thorne.*
Oklahoma—*Stillwater:* J. Fields.*
Oregon—*Corvallis:* T. M. Gatch.*
Pennsylvania—*State College:* H. P. Armsb
Rhode Island—*Kingston:* A. A. Brigham.*
South Carolina—*Clemson College:* H. S. Hartz
South Dakota—*Brookings:* J. H. Shepard.*
Tennessee—*Knoxville:* ——— ———.
Texas—*College Station:* J. H. Connell.*
Utah—*Logan:* J. A. Widtsoe.*
Vermont—*Burlington:* J. L. Hills.*
Virginia—*Blacksburg:* J. M. McBryde.*
Washington—*Pullman:* E. A. Bryan.*
West Virginia—*Morgantown:* J. H. Stewart.*
Wisconsin—*Madison:* W. A. Henry.*
Wyoming—*Laramie:* E. E. Smiley.*

---

* Director. † Assistant director in charge. ‡ Acting director.

EXPERIMENT STATION RECORD.

Editor: E. W. ALLEN, PH. D., *Assistant Director.*

EDITORIAL DEPARTMENTS.

Chemistry, Dairy Farming, and Dairying—The EDITOR and H. W. LAWSON.
Meteorology, Fertilizers and Soils (including methods of analysis), and Agricultural Engineering—W. H. BEAL.
Botany and Diseases of Plants—WALTER H. EVANS, Ph. D.
Foods and Animal Production—C. F. LANGWORTHY, Ph. D.
Field Crops—J. I. SCHULTE.[1]
Entomology and Veterinary Science—E. V. WILCOX, Ph. D.
Horticulture—C. B. SMITH and V. A. CLARK.
With the cooperation of the scientific divisions of the Department and the Abstract Committee of the Association of Official Agricultural Chemists.

EDITORIAL NOTES.

Page.
Scientific aids, Department of Agriculture 1
Editorial management of the Record 2
The new Imperial Agricultural Department for the West Indies 101
The late Henry Lévêque de Vilmorin 201
Plant breeding and selection as a feature of experiment-station work 202
Veterinary work of the experiment stations 301
Two views of the functions of experiment stations 401
The development of the respiration calorimeter 501
Experiment-station exhibit for the Paris Exposition 601
Occurrence of leucocytes in normal milk 701
Causes of the changes in ripening cheese 702
Statistics of agricultural colleges and experiment stations for 1899 801
Comments on the work of the stations for 1899 803
Recent investigations on Texas fever 901
The services of President J. H. Smart and Prof. G. E. Morrow 1001

SPECIAL ARTICLES.

Selection and its effects on cultivated plants, Henry L. de Vilmorin 3
Convention of Association of Official Agricultural Chemists, 1899, E. W. Allen. 204
Thirteenth annual convention of the Association of American Agricultural Colleges and Experiment Stations, E. W. Allen 405
Artificial changes of physical properties of soils, Ewald Wollny 604
Adaptation of methods of cultivation and manuring to the physical properties of soils, Ewald Wollny 805

---

[1] Absent on leave.

LIST OF STATION PUBLICATIONS ABSTRACTED.

	Page.
ALABAMA CANEBRAKE STATION:	
Thirteenth Annual Report, 1898	240, 241, 251, 295
ALABAMA COLLEGE STATION:	
Bulletin 100, December, 1898	145, 154
101, January, 1899	139
102, February, 1899	139
103, March, 1899	292
104, April, 1889	232
105, August, 1899	921
106, November, 1899	1041
Index to Vol. VI, Bulletins 89–100, January–December, 1898	296
Eleventh Annual Report, 1898	697
ARIZONA STATION:	
Bulletin 30, January, 1899	236
Ninth Annual Report, 1898	213, 239, 240. 253, 295
Tenth Annual Report, 1899	812, 833, 842, 847, 850, 855, 858, 888, 897
ARKANSAS STATION:	
Bulletin 56, March, 1899	242
57, June, 1899	689
58, August, 1899	921, 923, 926, 927, 965
Eleventh Annual Report, 1898	295
CALIFORNIA STATION:	
Bulletin 122, January, 1899	64
123, January, 1899	46
124, May, 1899	534
125, May, 1899	636
Seed Bulletin, 1899–1900	1047
COLORADO STATION:	
Bulletin 50, December, 1898	245
51, March, 1899	337
52, April, 1899	378, 379
Eleventh Annual Report, 1898	314, 323, 339, 370, 394, 396
CONNECTICUT STATE STATION:	
Bulletin 128, April, 1899	279
129, May, 1899	270
Twenty-second Annual Report, 1898	705, 719, 722, 730, 742, 745, 748, 750, 754, 755, 757, 762, 769, 777, 799
CONNECTICUT STORRS STATION:	
Bulletin 19, February, 1899	189
Eleventh Annual Report, 1898	819, 835, 873, 877, 882, 886, 890, 897
DELAWARE STATION:	
Bulletin 43, 1899	141, 185, 189
44, March, 1899	141
45, October, 1899	815
Tenth Annual Report, 1898	421, 430, 434, 435, 468, 473, 485, 490, 493, 496
FLORIDA STATION:	
Bulletin 49, March, 1899	334, 376
50, May, 1899	739
GEORGIA STATION:	
Bulletin 41, October, 1898	30, 39
42, November, 1898	147, 167, 173
43, December, 1898	138
44, September, 1899	841

GEORGIA STATION—Continued. Page.

Bulletin 45, October, 1899 864
46, November, 1899 .... 1018, 1030
Eleventh Annual Report, 1898 396

IDAHO STATION:

Bulletin 16, 1899 173
17, 1899 351
18, 1899 340
19, 1899 .... 313, 327
20, 1899 1059

ILLINOIS STATION:

Bulletin 54, March, 1899 258
55, June, 1899 633
56, July, 1899 654
Circular 13, December, 1898 82
Eleventh Annual Report, 1898 396

INDIANA STATION:

Bulletin 75, January, 1899 236
76, March, 1899 277
77, March, 1899 .... 335, 340, 356
78. May, 1899 657
79, June, 1899 667
Circular 1, September, 1899 898
Eleventh Annual Report, 1898 396

IOWA STATION:

Bulletin 40, 1899 388
41, 1899 647
42, 1899 651
43, 1899 958

KANSAS STATION:

Bulletin 82, January, 1899 171
83, April, 1899 236
84, April, 1899 349
85, April, 1899 .... 333, 377
86, June, 1899 498
87, April, 1899 420
88, May, 1899 487
89, June, 1899 432
90, January, 1900 1037
Press Bulletin 25 182
Eleventh Annual Report, 1898 897

KENTUCKY STATION:

Bulletin 79, December, 1898 137
80, March, 1899 169
81, March, 1899 .... 260, 261
82, July, 1899 627
83, August, 1899 731
Tenth Annual Report, 1897 .... 314, 323, 396

LOUISIANA STATIONS:

Bulletin 53 (second series), 1898 28
54 (second series), 1898 .... 39, 67
55 (second series), 1899 230
56 (second series), 1899 588
Eleventh Annual Report, 1898 295

MAINE STATION: Page.

- Bulletin 49, February, 1899 ... 158
  - 50, March, 1899 ... 137
  - 51, April, 1899 ... 279
  - 52, May, 1899 ... 262
  - 53, September, 1899 ... 829
- Fourteenth Annual Report, 1898 ... 908, 909, 912, 913, 917, 928, 929, 931, 942, 956, 958, 959, 960, 964, 965, 969, 971, 974, 975, 983, 987, 998

MARYLAND STATION:

- Bulletin 59, January, 1899 ... 62
  - 60, March, 1899 ... 260
  - 61, June, 1899 ... 441
  - 62, June, 1899 ... 440
- Eleventh Annual Report, 1898 ... 295
- Twelfth Annual Report, 1899 ... 820, 897

MASSACHUSETTS HATCH STATION:

- Bulletin 58, March, 1899 ... 137
  - 59, March, 1899 ... 137
  - 60, April, 1899 ... 174
  - 61, April, 1899 ... 159
  - 62, July, 1899 ... 528
  - 63, November, 1899 ... 1026
- Special Bulletin, August 10, 1899 ... 563
- Meteorological Bulletin 121, January, 1899 ... 128
  - 122, February, 1899 ... 128
  - 123, March, 1899 ... 128
  - 124, April, 1899 ... 222
  - 125, May, 1899 ... 222
  - 126, June, 1899 ... 222
  - 127, July, 1899 ... 432
  - 128, August, 1899 ... 432
  - 129, September, 1899 ... 432
  - 130, October, 1899 ... 715
  - 131, November, 1899 ... 715
  - 132, December, 1899 ... 715
- Eleventh Annual Report, 1898 ... 508, 509, 516, 525, 526, 527, 528, 529, 542, 543, 551, 561, 566, 568, 572, 576, 577, 599

MICHIGAN STATION:

- Bulletin 164, December, 1898 ... 40
  - 165, December, 1898 ... 96
  - 166, January, 1899 ... 188
  - 167, January, 1899 ... 186
  - 168, February, 1899 ... 153
  - 169, February, 1899 ... 252
  - 170, March, 1899 ... 250
  - 171, March, 1899 ... 252
  - 172, March, 1899 ... 390
  - 173, March, 1899 ... 386
  - 174, June, 1899 ... 528
  - 175, July, 1899 ... 954
  - 176, October, 1899 ... 931
- Special Bulletin 9, November, 1898 ... 698
  - 10, February, 1899 ... 842
  - 11, March, 1899 ... 252
  - 12, March, 1899 ... 274

MICHIGAN STATION—Continued.	Page.
Tenth Annual Report, 1897	30, 43, 50, 53, 54, 57, 58, 60, 61, 64, 86, 98
Eleventh Annual Report, 1898	1018, 1037, 1047, 1059, 1062, 1085, 1095
MINNESOTA STATION:	
Bulletin 59, July, 1898	179
60, July, 1898	175
61, December, 1898	170
62, March, 1899	638
63, July, 1899	812, 831, 843, 872, 883
64, October, 1899	861, 864
65, November, 1899	1018
Annual Report, 1898	323, 396
MISSISSIPPI STATION:	
Bulletin 51, January 15, 1899	39
52, January 15, 1899	39
53, March, 1899	272
54, March, 1899	241
55, March 15, 1899	229
56, April, 1899	253
57, April 15, 1899	229
58, May, 1899	328
59, June 15, 1899	528
60, September, 1899	1022, 1068, 1069, 1072, 1079, 1080, 1084
Eleventh Annual Report, 1898	821, 897
MISSOURI STATION:	
Bulletin 44, October, 1898	268
45, January, 1899	236
46, April, 1899	349
47, July, 1899	367
48, October, 1899	988
Circular of Information 9, March 23, 1899	898
Annual Report, 1898	1004, 1005, 1006, 1008, 1015, 1025, 1042, 1043, 1068, 1075, 1076, 1078, 1095
MONTANA STATION:	
Bulletin 16 (Fourth Annual Report, 1897), February 1, 1898	246, 251, 295
17, April, 1898	266
18, June, 1898	223
19, October, 1898	537
20 (Fifth Annual Report, 1898), August, 1898	1037, 1046, 1048, 1051, 1095
NEBRASKA STATION:	
Bulletin 57, April 3, 1899	240, 296
58, April 5, 1899	279
59, 1899	896
60, September 28, 1899	839
61, December 15, 1899	1030
Twelfth Annual Report, 1898	314, 370, 393, 396
NEVADA STATION:	
Bulletin 38, 1897	158
39, December, 1897	133
Tenth Annual Report, 1897	898
NEW HAMPSHIRE STATION:	
Bulletin 58, October, 1898	178
59, 1898 (Tenth Annual Report, 1898)	128, 136, 140, 145, 152, 153, 159, 169, 188, 197

	Page.
NEW HAMPSHIRE STATION—Continued.	
Bulletin 60, January, 1899	148
61, February, 1899	188
62, February, 1899	147
63, March, 1899	295
64, April, 1899	269
65, May, 1899	255
66, September, 1899	967
NEW JERSEY STATIONS:	
Bulletin 133, January 17, 1899	51
134, January 23, 1899	125
135, February 8, 1899	112
136, April 17, 1899	439, 440, 444
137, August 30, 1899	883
138, September 5, 1899	868
139, September 25, 1899	829
140, October 31, 1899	958
Annual Report, 1898	714, 718, 720, 735, 739, 743, 749, 750, 760, 777, 783, 791, 799
NEW MEXICO STATION:	
Bulletin 28, December, 1898	956
29, May, 1899	1035
30, May, 1899	1044
Seventh Annual Report, 1897	599
Eighth Annual Report, 1898	599
NEW YORK CORNELL STATION:	
Bulletin 160, January, 1899	50
161, January, 1899	49
162, February, 1899	81
163, February, 1899	162
164, February, 1899	164
165, March, 1899	282
166, March, 1899	237
167, March, 1899	294
168, May, 1899	322
169, May, 1899	384
170, May, 1899	368
171, July, 1899	389
172, September, 1899	866
173, November, 1899	1081
174, November, 1899	1022
175, November, 1899	1015
Twelfth Annual Report, 1899	898
NEW YORK STATE STATION:	
Bulletin 121, Appendix, March, 1899	172
149, December, 1898	76
150, December, 1898	63
151, December, 1898	49
152, December, 1898	170
153, December, 1898	295
154, December, 1898	235
155, December, 1898	238
156, December, 1898	257
157, December, 1898	248
158, May, 1899	269
159, October, 1899	865

	Page.
NEW YORK STATE STATION—Continued.	
Bulletin 160, October, 1899	917
161, November, 1899	945
162, November, 1899	1058
NORTH CAROLINA STATION:	
Bulletin 155, December 20, 1898	278
156, December 21, 1898	278
157, December 22, 1898	278
158, December 23, 1898	229
159, December 24, 1898	341
160, January 18, 1899	276
161, January 31, 1899	328
162, March 22, 1899	497
163, May 10, 1899	483
164, May 19, 1899	909
165, June 1, 1899	960
166, June 15, 1899	984
167, June 30, 1899	1073
168, June 30, 1899	1032
169, June 30, 1899	1078
Special Bulletin 51, December 16, 1898	909
52, January 10, 1899	997
53, January 17, 1899	970
Biennial Report, 1897 and 1898	1095
Twenty-second Annual Report, 1899	1095
NORTH DAKOTA STATION:	
Bulletin 34, December, 1898	264
35, January, 1899	214, 218, 224, 241, 279, 287
36, January, 1899	215, 226
37, March, 1899	361
38, April, 1899	325, 338
39, April, 1899	331
40, April, 1899	339
Ninth Annual Report, 1898	812, 817, 821, 823, 889, 898
OHIO STATION:	
Bulletin 96, September, 1898	62
97, December, 1898	160, 162
98, January, 1899	150
99, January, 1899	142
100, February, 1899	228
101, March, 1899	234, 257
102, March, 1899	274
103, March, 1899	267
104, March, 1899	357
105, April, 1899	356
106, April, 1899	472
107, May, 1899	476
108, June, 1899	691
OKLAHOMA STATION:	
Bulletin 37, April, 1899	277
38, April, 1899	223
39, May, 1899	391
40, May, 1899	386
41, May, 1899	354
42, June, 1899	433
43, November, 1899	929

OKLAHOMA STATION—Continued. Page.
Annual Report, 1899 .... 1015, 1017, 1022, 1036, 1051, 1057, 1061, 1066, 1067, 1069, 1076, 1084, 1090, 1091, 1096

OREGON STATION:
Bulletin 56, March, 1899 446
57, April, 1899 466
58, June, 1899 450
59, December, 1899 1034

PENNSYLVANIA STATION:
Bulletin 44, November, 1898 83
45, December, 1898 84
46, July, 1899 731
Annual Report, 1897–98 .... 436, 438, 452, 483, 496

RHODE ISLAND STATION:
Bulletin 50, December, 1898 29
51, December, 1898 80
52, February, 1899 262
53, April, 1899 435
54, May, 1899 438
55, June, 1899 645
56, July, 1899 627
57, August, 1899 641
58, August, 1899 642
59, September, 1899 1026
Eleventh Annual Report, 1898 .... 905, 908, 911, 914, 915, 917, 918, 924, 928, 944, 972, 994, 998

SOUTH CAROLINA STATION:
Bulletin 38, February, 1899 .... 153, 160
39, February, 1899 198
40, February, 1899 233
41, March, 1899 .... 463, 464
42, March, 1899 439
43, April, 1899 438
44, June, 1899 834
45, June, 1899 831
46, June, 1899 835
47, June, 1899 918
Annual Report, 1898 .... 1024, 1047, 1061, 1064, 1096

SOUTH DAKOTA STATION:
Bulletin 61, January, 1899 .... 43, 44, 51, 97
62, February, 1899 142
63, March, 1899 878
64, April, 1899 817
65, July, 1899 848

TENNESSEE STATION:
Bulletin Vol. XI, No. 1, April, 1898 .... 148, 149
2, June, 1898 927
3, September, 1898 927
4, December, 1898 927
Eleventh Annual Report, 1898 197

TEXAS STATION:
Bulletin 47, 1898 280
48, 1898 247
49, December, 1898 233

TEXAS STATION—Continued.	Page.
Bulletin 50, February, 1899	438
51, May, 1899	438
Eleventh Annual Report, 1899	1096
UTAH STATION:	
Bulletin 59, March, 1899	441
60, March, 1899	480
61, April, 1899	663
Ninth Annual Report, 1898	432, 459, 496
Tenth Annual Report, 1899	1091, 1096
VERMONT STATION:	
Bulletin 66, September, 1898	56
67, December, 1898	47
68, January, 1899	482
69, March, 1899	437
70, April, 1899	437
71, May, 1899	437
72, September, 1899	861
Eleventh Annual Report, 1898	307, 313, 315, 318, 321, 328, 336, 343, 347, 351, 352, 353, 354, 355, 370, 381, 382, 383, 384, 385, 389, 397
VIRGINIA STATION:	
Bulletin 79, August, 1897	66
80, September, 1897	183
81, October, 1897	120
82, November, 1897	128
83, December, 1897	198
84, January, 1898	191
85, February, 1898	190
86, March, 1898	173
87, April, 1898	190
88, May, 1898	455
89, June, 1898	495
90, July, 1898	494
91, August, 1898	851
92, September, 1898	838
93, October, 1898	925
94, November, 1898	931
95, December, 1898	1091
96, January, 1899	1074
Annual Report, 1898	197
WASHINGTON STATION:	
Bulletin 37, October, 1898	1055
38, May, 1899	1045, 1064
39, November, 1899	1094
Seventh Annual Report, 1897	898
Eighth Annual Report, 1898	998
WEST VIRGINIA STATION:	
Bulletin 53, December 31, 1898	34
54, January, 1899	251
55, March, 1899	239
56, April, 1899	475
57, May, 1899	438
58, June, 1899	583
59, June, 1899	774
60, June, 1899	774
Eleventh Annual Report, 1898	698

	Page.
Wisconsin Station:	
Bulletin 70, January, 1899	186
71, February, 1899	143
72, April, 1899	150
73, April, 1899	188
74, May, 1899	585
75, June, 1899	673
76, July, 1899	749
77, August, 1899	930
78, August, 1899	986
79, September, 1899	1095
Fifteenth Annual Report, 1898	511, 520, 521, 523, 528, 537, 540, 544, 560, 565, 567, 570, 571, 578, 579, 580, 581, 584, 585, 587, 595, 599
Wyoming Station:	
Bulletin 40, January, 1899	53
41, November, 1899	1026
Ninth Annual Report, 1899	1015, 1017, 1022, 1052, 1053, 1096

UNITED STATES DEPARTMENT OF AGRICULTURE PUBLICATIONS ABSTRACTED.

Farmers' Bulletin 88	133
89	145
90	293
91	260
92	296
93	278
94	250
95	395
96	381
97	397
98	397
99	370
100	381
101	539
102	539
103	599
104	517
105	599
106	983
107	999
108	927
109	999
Report 59	727
60	729
61	741
62	726
Yearbook, 1898	123, 425, 431, 432, 434, 443, 447, 450, 451, 452, 454, 457, 462, 470, 471, 482, 483, 490, 491, 497, 498
Division of Agrostology:	
Bulletin 16	219
17	219
18	423
19	423
Circular 9	28
10	23

Publication	No.	Page.
Division of Agrostology—Continued.		
Circular	11	219
	12	340
	13	339
	14	341
	15	709
	16	709
	17	926
	18	1033
	19	1015
	20	1033
	21	1032
	22	1033
Bureau of Animal Industry:		
Bulletin	23	89
Circular	26	390
Fifteenth Annual Report, 1898		909, 972, 976, 979, 983, 984, 987, 988, 991, 994, 995, 996, 997, 998, 999
Division of Biological Survey:		
North American Fauna No.	14, April 29, 1899	428
	15, August 8, 1899	429
	16, October 28, 1899	428
Division of Botany:		
Bulletin	21	51
Circular	17	497
	18	748
	19	725
	20	1047
	21	1047
	22	1047
Inventory	1	319
	2	319
	3	319
	4	319
	5	1015
	6	1015
Division of Chemistry:		
Bulletin	46 (revised)	509
	56	310
	57	1007
Circular	5	67
Division of Entomology:		
Bulletin	19 (new series)	362
	20 (new series)	950
Office of Experiment Stations:		
Bulletin	28 (revised)	379
	56	79
	57	23
	58	95
	59	98
	60	96
	61	98
	62	28, 31, 42, 98
	63	372

OFFICE OF EXPERIMENT STATIONS—Continued.

Page.
Bulletin 64 397
65 397
66 374
67 767
68 777
69 770
70 798
71 961
72 999
73 1093
Circular 39 98
40 98
41 799
42 799
43 777
Irrigation Investigations Schedule 1 798
2 798

SECTION OF FOREIGN MARKETS:

Bulletin 14 198
15 296
Circular 21 296

DIVISION OF FORESTRY:

Bulletin 22 746
24 855
25 853
26 938
Circular 22 745

DIVISION OF POMOLOGY:

Bulletin 8 544

OFFICE OF ROAD INQUIRY:

Circular 31 395
32 396
33 396

DIVISION OF SOILS:

Bulletin 15 325
Circular 3 912

DIVISION OF STATISTICS:

Bulletin 16 (miscellaneous series) 41
Circular 10 698
11 698
Crop Circular for May, 1899 397
June, 1899 397
July, 1899 397
August, 1899 397
September, 1899 898
October, 1899 698
November, 1899 898
Report 156 (new series) 397

DIVISION OF VEGETABLE PHYSIOLOGY AND PATHOLOGY:

Bulletin 16 942
17 944
18 1008
Circular 17 259

WEATHER BUREAU:	Page.
Bulletin 23	129
24	126
25	223
26	322
27	621
F	621
An Advance in Measuring and Photographing Sounds	622
Climate and Crop Report, Season of 1898, Alaska Section	129
Climatology of the Isthmus of Panama	517
Hydrology of Lake Minnetonka Watershed	223
Measurement of Precipitation	223
Meteorological Chart of the Great Lakes, Vol. II, No. 9	912
Monthly Bulletin of the River and Flood Service for October, 1898	223
Monthly Weather Review, Vol. XXVII, Nos. 1-3, January-March, 1899	221
XXVII, Nos. 4-6, April-June, 1899	429
XXVII, Nos. 7-9, July-September, 1899	620
XXVII, Nos. 10-12, October-December, 1899	818
XXVI, Annual Summary, 1898	29
Report of the Chief of the Weather Bureau, 1897-98	30
1899	621
Variations in Lake Levels and Atmospheric Precipitation	622

ILLUSTRATIONS.

Page.

FIG. 1. Apparatus for ash determination 305

2. Apparatus for determining the effective diameter of soil grains 524

3. Dairy barn and stock-judging building, College of Agriculture, University of Wisconsin 595

4. First floor of barn, showing stables, stock-judging room, etc 596

5. Perspective view of improved cow stall 597

6. System of ventilation 598

O

EXPERIMENT STATION RECORD.

VOL. XI. No. 1.

In accordance with the policy announced in the Report of the Secretary of Agriculture for 1898 graduate students will be given opportunities to avail themselves of the advantages for advanced study and research which are to be found in this Department and elsewhere in the national capital. An arrangement has recently been completed by which the Civil Service Commission will establish a register of "Scientific aids, Department of Agriculture." On this register will be enrolled graduates of the colleges which have received grants of land or money from the United States who may desire to enter the service of this Department at a salary not exceeding $40 a month. Besides furnishing a certificate of graduation the applicant is required to state what post-graduate courses, if any, he has pursued and in what special lines of science he has qualifications which would make his services useful to the Department. As a further evidence of his scientific ability he must submit a thesis on some subject of his own choice, or copies of original scientific articles published over his signature.

When openings for such candidates are presented by the work of any division of the Department, the Commission will be asked to certify the eligibles whose qualifications most closely conform to the requirements of the position to be filled. Once admitted to the Department the "scientific aid" will be expected to conform to the general regulations of the service, and to perform faithfully and regularly the duties assigned him by his superior officer. But he will be given opportunities to pursue some special line of study or research, and outside of office hours he will be able to take advantage of the many privileges which residence at the national capital affords, or in some instances he will be enabled to share in investigations which the Department is conducting outside of Washington. The term of service will depend very largely on the aptitude which the incumbent shows as an original scientific worker and the ability with which he discharges required duties, but in any case will be limited to two years. This limitation is made for the express purpose of putting the "scientific aids" on a temporary basis, with a view to encouraging their seeking outside positions suited to their attainments, or their fitting themselves to compete to advantage in the regular or special civil-service examinations which are held to supply eligibles for the permanent service of the Department. Such an arrangement is in a way comparable with that by which some colleges limit the term of service of their tutors or other junior instructors to two or three years, with a view to keeping them alert to fit themselves for higher posts in other institutions.

Under present conditions the number of scientific aids who can be admitted to the Department will be quite limited, so that only those who give evidence of superior qualifications for work along lines in which the Department is working may hope to be successful in their application for service. It is hoped, however, that when once the details of management of a corps of student assistants have been thoroughly adjusted by experience that the way may be opened for a larger force of this kind than can at present be maintained.

A large body of teachers and investigators are now being maintained throughout the Union at the expense of the nation and the States. To properly recruit the faculties of our State colleges, the staffs of our experiment stations and Government scientific departments, the graduates of our colleges need wider opportunities for graduate study. It is well that a part of their advanced study should be at the national capital and in connection with the scientific work which the National Government is carrying on. It is believed that it is a wise and economic plan to open the laboratories, libraries, and museums of the Government at Washington to the graduates of our colleges, and that the participation of an active and ambitious corps of the brightest and best of these graduates in the service of the Department will stimulate all the scientific workers in the service and promote the efficient pursuance of the practical ends for which all the scientific work of this Department is conducted.

It has been deemed proper to limit the register of "scientific aids" to the graduates of those institutions which are the beneficiaries of the national bounties, on the ground that this is simply carrying out the policy which Congress has established in making these colleges in a real sense national institutions.

With the present number active editorial management of the Record has been assigned to Dr. E. W. Allen, Assistant Director of this Office, and the duties of the Director will hereafter be confined to the more general supervision of this, as of other lines of work, in which the Office is engaged. This arrangement has come about through a gradual process of evolution and involves no change in the policy of the management of the Record. It is believed, however, that it will promote the greater thoroughness of our review of the literature of agricultural science, and, taken in connection with the recent strengthening of our editorial force, will enable us to make that review more complete and comprehensive than ever before.

SELECTION AND ITS EFFECTS ON CULTIVATED PLANTS.

HENRY L. DE VILMORIN.

The word *selection*, taken in its general sense, means *choice*. In natural history, when applied to plants or animals which man raises under domestication, it assumes a more restricted meaning and is applied only to the choice of individuals considered as agents of reproduction. It is in this sense alone that the word selection is used in this article.

The purpose of this paper is to indicate the reasons for making a certain choice, the results it may produce, the precautions that should accompany it, the practical methods of applying it, and the difficulties that may be met and may defeat the purposes in view.

Evidently the process is quite different from natural selection. The latter proceeds independently of man by the simple interplay of natural forces, while artificial selection is an act performed by man for the purpose of satisfying his needs and tastes. Nature modifies plants in *their* interest; man modifies them in *his;* but in the one case, as in the other, there is an acquirement of characters and a transmission of the characters acquired.

This article is not the proper place to discuss selection and its relation to evolution, of which the creation of varieties by selection is only one phase; nor is it the place to discuss the relative permanence of existing species. The task of the improver of cultivated plants is not to create new species but to establish and fix in known species well defined and constant races possessing distinct characters which may render them useful or agreeable to man.

The practice of selection is almost or quite as old as the practice of cultivation itself. It is certain that from the most remote beginnings of pastoral life primitive man has preferred the finest and best shaped animals for breeding purposes. In the same way when the culture of certain useful plants had succeeded to a more primitive form of pastoral agriculture or had become associated with it, the domesticated races of plants were gradually ameliorated by the diligence of some men who were more observant and interested than others; and the improved races were disseminated from place to place.

THE EFFECTS OF CULTIVATION ON PLANTS.

Much has been said of cultivation as a means of improving plants. The writer believes, however, that the selection of the individual intended to reproduce a sort has done infinitely more in this direction than cultivation, properly so called. Without doubt, the larger amounts of plant food, air, and room that are provided for the plant under careful cultivation, as compared with wild conditions, are the means by which some given plants attain to a greater individual development, but cultivation in general advances improvement principally because it gives to man an opportunity to observe the plant closely, to notice even the slightest variations in the characters of the different individuals, to note at the time of their occurrence all the variations which appear useful to him, and to fix them by sowing the seed from all the individuals that have shown these variations.

Superabundance of food supply undoubtedly favors the appearance in cultivated plants of variations which consist of multiplication of parts of a plant or the excessive development of certain parts among them, but heredity interferes to fix these characters, so that they are seen to persist in individuals escaped from cultivation and are perpetuated for a long time, even after the causes that brought them into existence have ceased to act.

SELECTION IN THE EARLIER AGES.

We possess few records bearing on the history of the improvement by selection of the various useful or ornamental plants in ancient times; yet the figures which have been left to us in paintings, mosaics, and sculptures indicate a notable improvement of the species cultivated by the Egyptians, the ancient Greeks, and the Romans, over the wild types of the same plants found in those regions at the present day. The leeks of Egypt, to the fame of which the sacred writings bear witness, are represented on the bas reliefs and paintings of Egyptian tombs as of a size far superior to that of the wild leeks of the mountains of central Asia, which, without doubt, represent the primitive type of the species. The Romans cultivated several varieties of *Brassica oleracea* that represented an immense advance over the wild type found on the coast regions of Europe. The flowers and fruits, figures of which are found frequently in Roman works of art, resemble more the varieties of the present day than the primitive types from which they were developed.

In passing it may be remarked, in reference to those fruits and flowers that are propagated by grafts and not by seeds, that selection is not entirely unconcerned in their culture, but even in such cases is found to exert its influence in several ways. A new variety generally originates from a seed which may have been accidentally planted, the resulting plant being reproduced and multiplied by grafting, or from seed planted by man, the various young plants being carefully observed from day to day and compared with each other, and meritorious novelties, if such appear, selected and propagated. In grafting, two things must be taken into consideration: In the first place, only those stocks should be used that are healthy, vigorous, as free as possible from defects and diseases, and well-provided with roots; and in the second place, the grafts should be taken from the youngest and healthiest shoots of the plant that is to be propagated and always from those that represent most faithfully the characters it is desired to reproduce. Sometimes variations are produced in plants by dimorphism, as by variation in the form or color of the foliage or in the shape or hue of the flowers, as often occurs in the chrysanthemum. There is then opportunity for the selection of the modified branch which is propagated by cuttings or any other method. The question of the permanence or running out of varieties of fruit trees, which is so often and so contradictorily discussed in the horticultural press of all countries, is intimately connected with this question of selection. There is no reason why a given type should run out if only proper stocks and healthy grafts are used in propagation, but the variety will certainly disappear if it is attacked by parasites to the extent that it is no longer possible to find a graft that does not carry with it its enemy.

To return to the history of selection of cultivated vegetables and flowers propagated by seeds. Italy, Provence, Flanders, and the neighborhood of Paris were, at about the beginning of modern times, the principal centers of the improvement of common plants. Seeds grown in these places bore a high reputation throughout Europe, and the popularity that they enjoyed shows that the characteristics developed in the various varieties of plants by these skillful and careful gardeners were well fixed, else they could not have reproduced themselves faithfully when cultivated under very different conditions of soil and climate. Vegetable gardeners have been for the most part the creators of European varieties of vegetables (and at the same time of many varieties of flowers, for the two occupations of vegetable gardener and florist were very often followed by the same individual as is frequently the case at the present day), and the uniformity, the constancy, and the cooking qualities of the varieties of vegetables originating in Naples, Milan, Lyons, Paris, and the Low Countries, bore witness to the skill, fine observation, and judgment in the application of selection which our predecessors possessed.

It is only since the latter half of the seventeenth century that the seed business has begun to be separated little by little from that of general gardening, and as division of labor always results in an improved product, the establishments that have devoted themselves exclusively to the growing of seed have come to do it better and more economically than the common gardeners whose time and effort were divided among various lines of production. In one respect, however, the competition of the market gardeners as well as that of the florists, properly so called, is still very useful to the careful seedsman in that it helps to keep him always in the front line of progress. To a less extent than the market gardener and florist the seedsman is brought in immediate contact with the consumer whose needs are the source of progress and new acquisitions. The former sometimes supply these needs, but often they turn to the seedsman and point out to him the prospect of increased profits as the reward for the creation of new and desirable varieties.

At the present day species that have been cultivated for many years have become, so to say, like wax in the hands of special growers, who mold them and fashion them to their taste, obtaining the various modifications of shape, size, flavor, etc., demanded by the preferences of their patrons and the caprices of fashion.

EXAMPLES OF SELECTION.

It would be difficult to select a more striking example of the variations that selection can develop and fix than the cultivated forms of *Brassica oleracea*. As already stated, this plant is a native of the coasts of western Europe, and is found on the shores of the Mediterranean, as well as on those of the Atlantic Ocean. The wild plant grows principally on the calcareous cliffs on the border of the sea. It is a semi-herbaceous, semi-ligneous vegetable, flowering from the second year onward, much branched and making each year both flowering branches and vegetative branches which are to flower the year following. The leaves are thick and fleshy, as are the flowering branches, while the stem and the crown of the root are also to a certain extent swollen and thickened. All of these characters will be found exaggerated greatly in the cultivated varieties of *B. oleracea*, but not all of them in any one race. Ordinarily one of the organs of the plant is selected with a view to obtaining one of the 20 or 30 forms of vegetables which, identical or nearly so with the others in their essential characteristics of flower and fruit, present most divergent forms as far as the organs of vegetation are concerned.

Cabbages, which form the most important group of cultivated *B. oleracea*, represent the plant reduced to its most simple form, that is, to a single erect stem bearing at its upper extremity numerous large, thickened leaves, more or less closely crowded together, which, according to their shape and the manner in which they are laid over each other, form heads that are oval (as in York Sugar Loaf), conical (Early Etampes, Pomeranian), spherical (Joanet, Holland Short Stem), or flattened (St. Denis, Brunswick). The same forms are found again in the Savoys, which differ from the ordinary cabbages in the form of development of the parenchyma between the little nerves of the leaves, giving the upper surface a blistered appearance: Oval (Long Headed Savoy), conical (St. Jean Savoy), spherical (Victoria Savoy), and flattened (Roblet Savoy).

Again, the same variety of forms is found among the red cabbages, where the entire leaf is colored a deep red: Conical (Red Conical), spherical (Red Dwarf Erfurt), flattened (Red Pologne).

All these forms without exception are the result of a patient and prolonged selection which has given to them almost complete permanence.

But these are not the only modifications of this plant, nor even of the leaves alone. There are the various headless cabbages or kale, which differ widely in respect to size, shape, and color. One of them, the collard (Rosette Colewort), has round, spoonshaped leaves, imbricated but not crowded together to such an extent as to deprive those in the middle of air and light and thus blanch them, as is the case with the inner leaves of the head cabbage. There are numerous varieties of kales with the leaves green or red, entire or laciniate, flat or curled; Portugal cabbage, cow cabbage, branched kales (*B. oleracea ramosa*), palm borecole, and many besides, among which Brussels sprouts is not the least strange. On a simple, straight stem are ranged petiolate, flattened, spoonshaped leaves. At the axil of each leaf is developed a little branch, the leaves of which fold over each other and are closely imbricated, forming a little hard head. Selection has solved the problem, apparently so difficult, of inducing the formation of heads on the branches of a stem without such formation at its top.

The stem of *B. oleracea*, as I have said, is in the wild type very large and capable of becoming thickened. Taking advantage of this tendency, selection has established a form the entire stem of which becomes large and fleshy and yields a product that can be used as a vegetable when it is young and tender, and is valuable as a food for cattle in winter when it has reached its full development.

If, instead of affecting the entire stem, the swelling is localized a little distance above the ground, the kohl-rabi is formed, the varieties of which are numerous, large or small, early or late, white or violet.

The capability of becoming thickened and fleshy is not limited to the stem. The tap root possesses it also, and plants which showed a marked tendency to vary in this way having been noticed and reproduced, have yielded, under the influence of long-continued selection, the turnip-rooted cabbage (*B. caulo-rapa*) and ruta-baga, the former of which has white flesh, the latter yellow. They are round, oblong, or flattened, and may weigh as much as 8 or 10 kg. Selection has produced these numerous forms from a root that weighs scarcely 1 or 2 ozs. in the wild state.

A still more remarkable modification was developed, as follows: The floral branch of *B. oleracea* is very thick and especially at the early period of its growth very tender and agreeable to the taste when cooked. Certain Italian gardeners noticed that the inflorescences of certain individuals had the sprouts larger and more thickened than others. Collecting the seed from these and selecting among the descendants of the second generation those plants which yielded the largest and shortest floral shoots, they have succeeded in creating the very characteristic modification known as the cauliflower. Here the pedicels of the flower have become very much thickened and flattened at the expense of the flowers themselves, which on the principal shoots have become atrophied and appear in small numbers only on the shoots of the third or fourth rank, which develop slowly on those heads which have not been cut at the time when they were good to eat. With the principal result once obtained, selection has produced varieties of cauliflower, early or late, of varying size, white, yellow, rose, or violet in color and of various degrees of hardiness.

Here, then, is a plant the different races of which have come down in culture under such different forms that an unusual keenness of insight or the aid of botanical science is necessary to explain that they truly belong to one wild type in which, in one case the leaves, in another the inflorescences, in still another the stem or the root, have been literally modified by the power of selection to such an extent that from infinitely slight variations at the beginning the differences between the various races have become greater than are often found in nature between different species of the same genus; and all of this has been accomplished by almost imperceptible steps under the influence of continued selection in a single direction.

Doubtless selection may be defined, but nothing can explain it so well as its results. For this reason I shall mention a few more examples taken from among the most common plants.

Take, for instance, celery. This is an aquatic perennial plant native in almost the entire basin of the Mediterranean, having its stem and petioles relatively large, tender, hollow, and of a pronounced aromatic odor. It was early observed in ditches and swamps, and introduced into cultivation. In the time of the Romans it was planted in gardens, more perhaps as an ornamental plant for use in domestic religious ceremonies than as a vegetable properly so called. When it came to be appreciated as a plant for the kitchen garden, it became an object of the gardener's attention. At first the size of the petioles was increased, then the plants with hollow petioles were eliminated as inferior to those in which the entire stalk was filled with tender, crisp flesh. Plants throwing up suckers were weeded out because growth force is always more economically utilized when it concenters about a single plant axis than when it is divided among several. The useful part of the celery being the stalk or petiole of the leaf, efforts were and are still directed toward the development of this organ by reducing others to the smallest size compatible with the good growth of the plant. The variety Pascal is very near to the present ideal of a green celery. The self-blanching celery was found in the neighborhood of Paris perhaps a dozen years ago by a very successful market gardener, Chemin. The original plant yielded seed from which was raised a good proportion of the new variety, but also some green plants. By persistent selection the proportion of green plants has been considerably reduced, but they have not yet entirely disappeared. By way of compensation this race has yielded a pretty variation with rose-colored ribs, which is becoming fixed. White Plume and Boston Market are two good American varieties. The latter throws up many suckers, which is considered a defect according to European standards. But attention has not always been concentrated upon the petioles of the celery. Connoisseurs have not failed to observe that the fleshy roots on which the leaves are inserted possessed an especial flavor and were sweeter, although not of as clear a color as the stalks. By selection certain plants have been obtained in which the root has been modified into a large, well-shaped, and very regular, rounded enlargement, as in the Erfurt and Prague turnip-rooted celeries.

It should be noted in comparing the various races of *B. oleracea* that but one organ is enlarged. If this organ is the root, the leaves and the petioles are proportionately diminished in size and serve only as auxiliary organs to the root. It is very difficult in general to develop two organs at the same time to any great degree in the same plant. In support of this assertion the beet may be mentioned, as the history of its cultural evolution presents many analogies to that of the celery. I shall devote only enough time to it to point out certain differences between these two vegetables. In the first place, in the case of the beet it is the kind of root developed that is of greatest importance. In this case the leaves are only the organs of assimilation and of transformation of the food absorbed. The form having the leaves, or rather the petioles and ribs of the leaves very much enlarged and the root small, branched, and fibrous, is known as the Swiss chard. Whenever there occurs an enlargement of the stalk or petioles properly so called, one may be certain that a decrease in the size of the root has already occurred or will occur immediately.

The deep red color of garden beets is of very great importance. But in sugar beets, the absence of color—that is, the perfect whiteness of the flesh of the root—is a condition of perfection. Selection has produced this very remarkable specialization. There is no necessary or absolute correlation between the color of the root and that of the foliage. In garden beets a thick, tender, sweet, and richly colored flesh is much desired. Now, a variety may have these qualities without its foliage showing, at least for the greater part of the growing period, any particularly deep coloration. In England it was the fashion to produce varieties of garden beets with large and deeply colored foliage (as in Dell's Dark Leaf beet). Some men of independence and good judgment have not hesitated to say that this is putting color to a bad use; that it is better to concentrate it in the root. As a matter of fact, the dark red Egyptian and Cheltenham Green beets and among the American varieties Edmand Early Turnip are living proofs that a variety may have finely colored roots and at the same time preserve in its leaves a noticeable proportion of green surface. A third class might be made of those having very deeply colored reddish brown foliage, which are used for decorative purposes only, as for instance, the Dracaena beet. But in agreement with the rule already laid down, this race has a small root of no culinary value.

I can not conclude this list of plants which have been modified by artificial selection in such divergent directions and which so plainly bear the impress of man's activity, without mentioning a few ornamental plants as well as garden vegetables.

Take for instance the amaranth. This is an annual plant from India of rapid growth with large alternate oval leaves and inconspicuous flowers in large bracteate clustered spikes. It has become, under the influence of selection, in one case a vegetable esteemed for its large and thickened leaves; in another case an ornamental, valued also for its leaves, which in this instance are variously colored and variegated; and in a third case it is valued for its inflorescence, which is so curiously modified that one would hardly recognize at first sight the original type in the strange variations that have been developed from it.

Let us consider only the extremes, the cockscomb and the feathered celosia. The former is a low-growing stocky plant with its flowering head enormously developed. An accidental fasciation of the stem has been fixed by selection and augmented to such an incredible degree that the size of the stem at its top must be measured by dissecting all the reduplications which form the part of the plant called the comb. This colored velvety mass, so ornamental in its bizarre effects, is the simple modification of an ordinary straight cylindrical stem into the comb.

From the same original type has been produced another entirely different plant. This is the feathered celosia, which is as graceful and light as the other is massive and stocky. Whereas all the stems were united into one in the cockscomb, they are here distinct, erect, and divided into ascending branches, each one of which ends in a plume having a varying number of filaments furnished with bright colored, silky bracts, and vary from golden yellow, through flame color and crimson to deep violet. In spite of such great differences in appearance between the two plants, it is not possible to observe the botanical characters and fail to recognize that both are modifications of the same original species.

From the same root are produced still other formations in which the ornamental part is not the inflorescence but the leaf, which is zoned or flagellated or bordered, sometimes with brown on a green ground work, or sometimes with bright red on yellow or brown or even simply on a brighter shade of red. All these pretty variations are the result of selection acting on the various forms found in nature or on modifications induced and patiently accentuated by man.

If it were not for the danger of making the list too long, many other examples of profound modifications brought about by the action of selection on the natural characters of wild plants could be mentioned. A single example that has been produced entirely within recent times will be instanced. The canna was introduced into garden culture about 1820 as a foliage plant; seeds were sown to obtain variations of form and color of foliage, and the success of M. Année in this respect is well known. More recently M. Crozy, of Lyons, and other growers have directed their efforts to increasing the size of the flower, as a result of which we have the large flowered varieties that to-day rival the gladiolus for garden decoration in summer. At the same time the color of the flowers has increased in brilliancy. It may be said indeed that hybridization has not been entirely unconcerned in this increase of size, but it is none the less selection that has taken advantage of the tendency thus introduced into the plant as a result of crossing, and that produces for us each year better varieties, the series of which is still far from being exhausted.

APPLICATION OF SELECTION.

If plants did not vary there could be no selection. The object of selection is to establish, fix, and sometimes to develop in plants certain qualities or new peculiarities which a plant has shown and some one has noticed.

It is not difficult to select plants. Anyone can do it, but it is not so easy to do it profitably. In order to succeed, one must be not only patient, attentive to the work in hand, but must also exercise judgment and common sense.

Every modification that a plant shows is not necessarily worth fixing. Experience alone can tell whether it is worth perpetuating. The Chinese primrose is one of those plants that within a short space of time, that is, within fifty or sixty years, has produced a very great number of good varieties under the influence of selection. It seems that any new character that appears in these plants is easily established. Several times I have found in cultivation, both at Paris and in the Riviera, certain bordered flowers, that is, flowers having a lighter colored border around a deeper colored disk, but all of my efforts to fix this pretty variation have thus far been in vain.

When a variation in a cultivated form is noticed, one should ask himself first whether it is worth fixing; for it is very evident that it would be time and labor lost if anyone should devote himself to the fixation of a character having neither interest nor usefulness. Several years ago a gardener brought to the writer a plant of a new celery that he had happened to find in a seed plat. He had transplanted it, saved the seeds from it, and sowed them, with the result that the type was reproduced very faithfully. It was a celery in which the pedicel or leaf stalk was shortened almost to the point of disappearance. The many crowded leaves spread over the ground in a compact rosette, but the plant had practically lost the very part that made it useful as a vegetable, that is, the stalks. I told him so and did not conceal from him the fact that his novelty appeared to me to mark a step backward and not forward, somewhat as if one had discovered a potato without tubers. I could not convince him that his novelty was not a fine thing, and I believe he actually found a house that introduced it into trade among their novelties. If horticultural novelties were a rarity, one could realize that anything new would be received with eagerness, but, as a matter of fact, novelties superabound, and one is tempted to say that the greatest virtue of a plant breeder is to be severe toward his own creations and not easily to become enthusiastic over their real or supposed merits. Hence, good judgment and experience are necessary in order to decide, when a variation appears, whether it is worth propagating or not with a view to establishing a new variety in the course of time.

If, as is most often the case, there is but one plant that shows the modification, the only thing to do is to collect the seeds from it to be planted again. But even here there are certain precautions to be taken. If the plant is one of those in which cross fertilization takes place easily, it is advisable to remove the possibility of pollination by plants of the same kind which might be in the vicinity. There are two ways of doing this: One is to destroy all plants of the same kind except the one to be propagated. The other is to cover the flowers of this plant so that they are protected from the pollen of other plants. It is advisable, if the flowers have already begun to open when the variation is noticed, to destroy all those that might have been fertilized by the pollen of any other plant, as this would introduce an unknown parentage into the race.

For the sake of simplicity I shall first consider the commonest case, that of a plant capable of self-fertilization, or one in which the different flowers of the same plant can fertilize each other, and do not require the aid of another plant of the same species. Seeds will then be collected only from those flowers which open after the plant has been covered. Suppose now that we have before us the seeds gathered from a plant that has shown the variation which we wish to propagate. The first thing to do is to sow these seeds in order to obtain a considerable number of young plants. The chances of finding something satisfactory among them naturally increases with the number of individuals among which we can choose. In this connection two important points are to be observed: (1) The inequality which is found in different cases in the proportion of plants conforming to the desired type in the first generation after the beginning of the selection. Sometimes, as has already been said, a single one is not obtained. Certainly this result is not encouraging; nevertheless this is not always an unqualified reason for abandoning the task to which one has set himself. Occasionally it happens that by gathering the seed from the plants of the second generation, the characteristics of the plant originally selected may reappear in the following generation.

Sometimes, on the contrary, the observed variation may reproduce itself completely and entirely in the first generation. This case is rare, but nevertheless it does occur. One day I noticed in a lot of double violet clarkias a plant with pure white double flowers. When gathered and sown by themselves, the seeds of this plant yielded only pure white flowers which have never varied. The race was established in a single generation. Generally, however, the result is intermediate—that is, certain individuals show the desired characters, while others revert to the earlier form. We shall consider in due season the proper method of procedure in a case like this. Meanwhile, I must take up the second point to which I have already referred, which is: (2) The necessity of sowing the seed under normal conditions. By these, I mean conditions which are not such as will influence artificially the characters of the plant produced by these seeds. In other words, structural or other peculiarities which the plants show should be the result of their natural tendencies and not the artificial result of cultivation. In a word, the plants under observation must have the opportunity to show their defects as well as good qualities. It goes without saying that a selection can not be useful and valuable unless so made. One must be in a position to decide that a plant behaves in a certain manner because it has an innate tendency to do so, and that it has not been constrained to a certain form artificially. An illustration will make my point better understood than many explanations. In selecting sugar beets those roots are sought for that are straight, long, and free from lateral branches This is right, for those that are branched are more difficult, and hence more expensive, to gather. Now, certain growers of beet seed in the north of France once formed the idea—thinking, no doubt, in this way to improve their varieties—of growing the plants which were to be used as seed stocks in very rich deeply worked soil, where they were very much crowded together; so much so that 16 to 20, or even more, grew on one square meter of ground. The result was that the beet assumed the form, and later the length of a thick whipstock. They were not branched because the roots were very closely crowded together. Their sugar content was abnormally high as a result of their growing so close together, and the conclusions drawn from the form of the roots and their sugar content, as determined in the laboratory, were tainted with error because they did not represent qualities truly acquired, but modifications accidentally imposed by external conditions. Thus these beets which were declared to be of good shape and composition in the laboratory yielded seed which, when sown in the open field, produced branched roots of only moderate sugar content, because the descendants had reassumed their true characters when they were released from the restraint which had been artificially imposed on the parent plants. Those beets, alone, may be considered unbranched that are free from roots when they are cultivated under conditions that would permit them to become branched if they had such a tendency. In order to obtain seed that will produce unbranched roots, the plants from which the selection is to be made must be grown under conditions as nearly as possible like those under which the same kind of plants are commonly grown that are intended for common domestic or industrial uses.

Let us return to a consideration of the successive operations of selection. Suppose that we have before us a lot of plants grown from seed of the plant which forms the point of departure in the establishment of a new variety. Of these plants some are *true to type*—that is, they reproduce faithfully the characters which we desire. Others have reverted to the older type and we destroy them. We also destroy those which correspond only imperfectly to the ideal which we have set before ourselves. Let us suppose that the tenth part of these plants are true to type and that we have twenty satisfactory plants before us. There are then open to us two methods of procedure. There is the method by individual selection of single plants and that of individual selection by group lots. The former is much the more exact, more simple, more direct, and less liable to error. But it has the disadvantage of being slow of operation, for at the end of three or four generations the grower still has only the seed produced by a single plant, and 2 or 3 years are still required to produce a large enough stock to introduce it into trade.

The method by group lots operates more rapidly and at the same time affords a considerable probability of establishing the variety. It consists in selecting not a single plant, but as large a number of perfectly satisfactory plants as can be found by individual examination of all the plants in the lot. These plants are grown together, the seeds are collected in one lot, and are planted the following year (if the plant is an annual) in order to obtain a larger number of plants, from which a larger number of individuals may be selected than in the preceding year, thus providing a good quantity of the seed of the improved race in a short time. The weak point in this method is that one does not know in what manner each individual plant has reproduced itself, so that in selecting a good plant one does not know that it was not derived from a parent that produced only 5 or 10 per cent of seed of the improved variety, the other nine-tenths reverting to the earlier type. This may happen and, of course, hinder the complete differentiation and establishment of the race.

There is a method that may be said to be intermediate between the two already described, which embraces, to a great extent, the advantages of both without their disadvantage. It is the method of seeding by single plants. This method requires somewhat more labor and attention. It is as follows: In the first generation from the original plant, instead of selecting only one individual as in the first method, several are chosen, all of them perfectly satisfactory in appearance, but instead of sowing them together and collecting the seed in a mixture, as in the second method, each is grown sufficiently far away from the others to avoid cross fertilization and the seed from each plant is collected separately. Each lot is again sown separately the next year and when the time comes to make a selection, the first step is to note to what extent each of the lots thus obtained has faithfully reproduced the characters of the plant from which it is sprung. (For the sake of clearness and convenience each plant selected receives a number or letter by which it is designated and its pedigree may be followed). A great difference is generally noticed in the behavior of the different plants in respect to the transmission of their characters. Those that do not reproduce the desired characters are entirely rejected. If any are found, as often happens, that reproduce entirely those of the parent plant, such plant or plants only are preserved, and their descendants may be used immediately for the multiplication of the new variety, which is thus established with a constancy that the best horticultural varieties do not always possess.

This process of seeding by individual plants is one of the most powerful means which the plant breeder possesses to establish with certainty and relative quickness new varieties of cultivated plants. About 20 years ago I applied this method to the improvement of sugar beets, a work that was begun by my father in 1850 and that I have made one of my principal lines of business for 25 years. In the laboratory of Verrières, as everywhere else at the present time, the roots of the sugar beet are submitted individually first to a physical selection as to size, form, color, etc., then to an examination by the polariscope for their sugar content. After this the most perfect roots are replanted and the seed from each one is collected and kept separate, but still before using this seed for the multiplication of the variety on a large scale, those plants must be determined which, beside their own characters, are endowed with that special quality which consists of faithfully transmitting those characters to their descendants. A small sample of the seed from each root, enough to produce about 50 plants, is sown the next year. The roots produced are examined physically and chemically at the laboratory in the usual manner. If the result of the test is unfavorable, the rest of the seed is thrown away; but if the test is favorable—that is, if the roots from which the seed was produced have demonstrated that they reproduce and transmit faithfully to their descendants the qualities for which they were chosen—the rest of the seed is sown with suitable care so as to obtain as great an increase of the variety as possible. Now, it is a fact of observation that individual plants or animals are very unequally endowed in this respect. I have already referred to this fact when I mentioned the case in which a new variety is established in a single generation. In an article on heredity, written in 1856, my father has so well presented this matter of the varying ability of individuals to transmit their own characters that I can do no better than quote the entire passage:

"An example drawn from the animal world will make this idea clearer. Suppose two stallions, eminently remarkable for eight characteristics, the same for both. Let the first of these characteristics be that of a fine head and shoulders, with the head shapely and well poised. We will not mention the other characteristics, which are of no importance to our argument, and pass directly to the eighth. Let this eighth characteristic be that of being a good stallion, and, since we are only making a supposition, we will define this by saying that it consists in the ability to transmit to descendants seven-eighths of his own characteristics. Now let us advance one generation and consider two male offspring of these animals. The first has transmitted seven of these characteristics, but he has not transmitted the first; hence this colt will have a head that is too large, badly poised, and he will not carry it well; but, as he has received the quality of being a good stallion, he will transmit with tenacity to his descendants his unshapely head, compensated, however, by his other good qualities. Let the offspring of the second stallion, on the other hand, possess all the visible characteristics of his father and be, to all appearances, a fine horse. But he has not received the eighth quality. In the second generation he will show his great defect. His offspring will have no common family resemblance and all the fine qualities which he received from his sire will thus be lost to the further improvement of the race. This ability to impress a very pronounced character on their offspring, which certain stallions possess to a much higher degree than others, is a fact well known to those who devote themselves to the improvement of domestic animals; but it is not generally known that in the plant world this fact is even more pronounced, so much so that certain plants endow their descendants with such prepotency that a race, equivalent almost to a species group, is formed at a single leap, while at other times thousands of individuals may be raised from a plant showing some noticeable peculiarity without a single one of them reproducing the distinctive trait of the parent. But as this ability to transmit a specific character is not indicated by any external characteristic and the result alone reveals its existence, it becomes necessary to be able to eliminate from the second generation all of the descendants of a plant imperfectly endowed in this respect; and for this reason I have been led to make it an absolute rule to keep the seed from different plants separate and not to mix the seed of two plants intended to be used in improving a race, no matter how perfect and how much alike these plants may appear."

When, after two or three generations, it is seen that the new variety is not becoming constant, that at each generation the reversions to the old type or variations in all directions are still found, it is better to abandon the selection entirely, or rather, cease to apply it to this lot, which is possibly lacking in the ability to transmit acquired characters, and to seek another point of departure in another individual better endowed in this respect.

DIRECTION OF SELECTION.

The characters that have determined the selection of a certain plant have just been spoken of. It is understood that anyone engaged in the selection of plants or animals is selecting for the purpose of improvement. Man's efforts to modify a plant by means of selection, however, may be more or less skillfully directed. Besides, the result obtained, though expressing exactly the breeder's ideal, may be very differently estimated according to the circumstances and the country. The ideal of a fruit, vegetable, or flower varies greatly according to the tastes of different persons, and the influence of these different tastes must make itself felt in one way or another in the direction given to selection.

There are certain considerations of common sense that must be observed under all circumstances, which, if forgotten or disregarded, will lead to unfavorable results that will everywhere be recognized as such. It would be useless to attempt to unite in one and the same plant two characters which antagonize or interfere with the utility of each other. For instance, certain very dwarf beans are often widely advertised as producing pods of wonderful length. If the description is exact, and there is no reason to doubt that it is, the pods being longer than the stem that bears them, they would touch the ground and very often rot from contact with the damp soil. Common sense would show that very long pods should be borne by pole beans and that very dwarf varieties should bear short but numerous pods.

For several years very large flowers have been the fashion and pansies and begonias are shown in which the flower is as large as the open hand. It has never been demonstrated that this is progress in a right direction. These flowers that are so large and abundant have not always the substance and stiffness necessary to hold them upright. The result is that they bend under the slightest unfavorable atmospheric changes or often even under their own weight and frequently become much less beautiful than smaller but more substantial and numerous flowers. There is another instance of improvement, so called, which I am not alone in considering quite the opposite. There is a very pretty species of helianthus (*H. cucumerifolius*) which is much esteemed in America and in Europe as a cut flower in summer. Its flowers, 3 or 4 in. in diameter, are of a pretty shape and superb golden color relieved by a black center. They are much sought after for sheaves and large bouquets. A florist has selected a variety called Stella which produces a much smaller number of flowers, 6 in. or more in diameter, like those of small varieties of *H. annuus*. With the loss of its abundance of flowers this plant has also lost the grace and lightness which constituted its especial merit.

The above example brings out a point that must be taken into consideration in selection. It is that there exist in nature certain laws of equilibrium or of compensation that must be taken into account; as, for instance, the law that the size of the organs in any given variety of plant varies inversely as their number. The same variety does not produce both very large and very numerous flowers. This fact is especially noticeable in the cultivated cineraria (*Senecio cruentus*). The flowers, which in the wild plant are scarcely as large as the flowers of the true daisy (*Bellis perennis*), are usually bred to resemble those of the ox-eye daisy (*Chrysanthemum leucanthemum*). This is not a wise application of selection. When of this size, the flowers that a well cultivated plant bears are no more than 50 or 60 in number. They cover the plant less completely than when they are a little smaller, but are 100 or 150 in number. The effect in the latter case is the more satisfactory. The details are lost in the mass of color, and abortive or accidentally injured specimens do not break the solidity of the mass as when the flowers are individually of such size that the removal of one of them necessarily leaves a gap.

Neither can a plant be expected to be at once very productive and very early. Time is an element of considerable importance in the growth of plants. The plant that grows under favorable conditions of temperature and light for a month longer than another will necessarily produce a considerably greater weight of organic matter, but there are many cases in which great earliness is an absolute condition of production. It is understood that under such conditions earliness is sought before anything else. It is a local necessity that must be taken into account. The problem of selection is almost always complicated with particular local requirements, and this explains the extreme multiplicity of cultivated varieties which certain people condemn without considering the reason for their existence.

The rôle of selection has been of the greatest importance in the past, as can be seen by the examples already cited. It will continue to be of immense importance in the future, for it is certain that mankind, in proportion as it increases in number and takes possession more and more completely of the surface of the earth, will be obliged to obtain from it more and more of food and other useful products. To accomplish this, man must improve animals and plants, which are the instruments of organic production, just as he improves the implements and machines which are the instruments of industrial transformations. Moreover, mankind will be compelled to apply selection not only to species already known, but also to those which are yet to be discovered.

Up to the present time selection has been applied particularly to annuals or biennials, plants in which generations follow each other rapidly. Under the management of corporate bodies, such as associations and local governments, it could be applied, for example, to forest trees, in which the difference between the best and poorest specimens, as is well known, is extremely great. Since a well established race of sugar beets has been obtained, why should not also a cork oak be bred, the cork of which will be of rapid development and faultless texture? The value of such a cork would be double or treble that of the ordinary article.

HOW SHOULD SEED BE COLLECTED FROM PLANTS?

In concluding these notes on selection, it appears advisable to touch upon a point to which certain people attach great importance, but on which my opinion does not agree with that usually held. I refer to the custom of collecting seeds from some certain part of a plant in preference to another. There is no idea more prevalent in gardening than that of the superiority of seeds collected from the base of the central stem over those of the top of the same stem, and especially over those of the lateral branches. I have made and had made experiments on this subject, and I have invariably found no difference among the seeds collected from various parts of the same plant with respect to the proportion of single and double plants obtained. I have repeated these experiments many times on ornamental plants with respect to the doubling of flowers, on vegetables with respect to the size and quality of the roots, and on cereals with respect to the yield in weight and the appearance of the seed, and I have always found that while individual plants may differ from each other in respect to the transmission of characters, yet from the same plant there was great uniformity of results obtained. The larger seeds produce slightly more vigorous plants in the earlier periods of growth, but do not give any guaranty of ability to transmit superior qualities. When a plant is known to be thoroughbred, and its ability to transmit its own characters has been established, I should always prefer the smallest seed that came from it, although collected from the part of the plant which is considered the least favorable in the common opinion, to the largest seed taken from the part believed to be most favorable, of a plant whose pedigree is less certain.

CONCLUSIONS.

Selection is the surest and most powerful instrument that man possesses for the modification of living organisms.

Variations are easily induced by change of environment and cultivation. The latter is an addition of especial importance, because it permits variations which are spontaneously produced to be easily observed and selected.

These modifications may affect the external characters of form, shape, and color, or the internal qualities of flavor, perfume, chemical composition, etc.

Selection may modify organisms in any direction not incompatible with the preservation of life, but there are certain characters that are mutually antagonistic: Individual size and number of parts, great productiveness and extreme earliness, relatively large size of a part, and very intense coloration. In order to be effective, selection must be continued in one and the same direction.

The value of the results obtained depends on the ability and judgment of the breeder. Varieties may degenerate as well as improve under selection.

The unit of selection is the individual. The superiority of one seed over others from the same individual, with respect to the transmission of characters, can not be foretold.

RECENT WORK IN AGRICULTURAL SCIENCE.

CHEMISTRY.

The inverting power of tartaric, citric, and oxalic acids upon sucrose, H. GILLOTT (*Bul. Assoc. Belge Chim., 13* (*1899*), *Nos. 2, pp. 80–94; 3, pp. 119–130*).—A critical study of the influences of time, quantity, and kind of acid, and concentration of the solution upon the inversion of sucrose. Numerous tables are given, from which the following conclusions are drawn: (1) Tartaric acid possesses greater inverting power than citric acid; (2) oxalic acid manifests a greater inverting power than either tartaric or citric acid; (3) for each of the three acids named the amount of sugar inverted increases considerably with the temperature, amount of acid, concentration of the solution, etc.; and, (4) the temperature, the quantity of acid, and the quantity of sugar remaining constant, the amount of sugar inverted increases with the duration of action.—H. SNYDER.

Notes on the hydrolysis of cellulose by acids, G. W. ROLFE and W. H. BARLOW (*Tech. Quart., 12* (*1899*), *No. 1, pp. 51–61*).—This is a preliminary study of the products of the hydrolysis of cotton cellulose by means of decinormal sulphuric acid under pressures varying from 1 to 8 atmospheres. The specific rotary and cupric reducing powers of the soluble products formed at different stages of hydrolysis were determined and the results platted. The authors believe they have succeeded in considerably diminishing the experimental error of other investigators. By the method of hydrolysis employed less than 10 per cent of the cotton was hydrolyzed into soluble products. These products are believed to be in the main dextrose and xylose. Intermediate conversion products which are practically insoluble are formed during the process.

Observations on the determination of nitrogen by the Kjeldahl method, L. MAQUENNE and E. ROUX (*Ann. Agron., 25* (*1899*), *No. 2, pp. 76–82; Bul. Soc. Chim. Paris, 3. ser., 21* (*1899*), *No. 6, pp. 312–314; Rev. Chim. Analyt. et Appl., 1* (*1899*), *No. 5, pp. 145–119*).—An account is given of an investigation of the various sources of error in this method, such as incomplete digestion and the evolution of acid fumes when sodium sulphid and sodium hydroxid containing carbonate are used.

To avoid the error due to the evolution of carbon dioxid when carbonated soda solution is used, the authors recommend that a small basket containing pumice stone be suspended in the neck of a distillation flask before the soda is added. To do away with the error due to volatile sulphur compounds, sodium hypophosphite is substituted for sodium sulphid as a precipitant for the mercury. About 1 gm. of the hypophosphite is required for the precipitation. After adding the hypophosphite the solution is heated for a few minutes at 70 to 80° C. and cooled before the soda is added and the distillation commenced.

In tests made on colza cake, ground horn, and dried blood, the decomposition was complete only when digestion was continued for from ½ to 1 hour after the solutions had become colorless. It was found that all of the ammonia was carried over in the first 45 cc. of the distillate.

The iodometric method of determining the ammonia is not considered to possess any advantages over the ordinary acidimetric method.

The estimation of nitrites and nitrates, A. W. BLYTH (*Chem. News, 79 (1899), No. 2049, p. 102*).—The author has devised an apparatus in which nitrites and nitrates, either singly or together, can be determined as nitric oxid by means of ferrous chlorid.

> "The essential feature of the apparatus is a mercury valve which is made by connecting one end of a long delivery tube with the side tube of a flask and causing the other to dip below the surface of mercury in the mercurial trough, the bend of the delivery tube being 770 mm. above this level. The air from the flask is expelled by boiling, and a special feature is made of the ease with which successive vacua can be obtained in such a flask. The author has found that nitric oxid is evolved from nitrites at once, whereas there is an appreciable interval of from one to two minutes before any nitric oxid is formed from nitrates. Nitrates yield the whole of the nitric oxid only when the flask is evacuated several times. The results obtained with the apparatus are accurate."

Methods for the quantitative determination of fat in organs, W. KNOPFELMACHER (*Oesterr. Chem. Ztg., 2 (1899), No. 5, pp. 122–124*).—The author reviews the different methods which have been used for fat determination in meat, etc., showing the ineffectiveness of the old methods of extraction. He concludes that the choice lies between Dormeyer's method of digesting the material with pepsin and hydrochloric acid previous to extraction (E. S. R., 7, p. 919) and Frank's method of treatment with alcohol for 24 hours before extraction. The latter is simpler, although it does not secure quite as much fat as Dormeyer's method. Only investigation can decide which of these two methods is best adapted to the purpose.

Note upon the detection of horseflesh in sausage, F. JEAN (*Ann. Chim. Analyt. et Appl., 4 (1899), No. 3, pp. 81, 82*).—Glycogen is determined as follows: The suspected material, in a fine state of division, is macerated in water for an hour at 60 to 70°. To the liquid obtained by pressure a few drops of acetic acid are added. The soluble albuminoids are removed by coagulation and filtration, and the liquid reduced by evaporation to 20 cc. When cool, 100 cc. of 95 per cent alcohol is added to precipitate glycogen, which is collected on a filter, washed with alcohol and then with ether. The glycogen is finally dried and weighed. The iodin reaction of Brautigam and Edelmann for the detection of glycogen is described. No analyses are given or standard proposed.—H. SNYDER.

The variation in the composition of Paris green, with a scheme for its analysis, T. B. STILLMAN (*Stevens Indicator, 15, pp. 233–240; abs. in Tech. Quart., 12 (1899), No. 1, Rev. Chem., p. 15*).—The composition of pure Paris green, aceto-arsenite of copper, is given as CuO, 31.29 per cent; As_2O_3, 58.65 per cent; and $C_2H_4O_2$, 10.06 per cent. "Adulteration as such is said to be rare in this country, although many samples show an excessive amount of arsenious acid, and the commercial material does not give uniform results when used as an insecticide. Foreign samples are frequently adulterated with barium sulphate, calcium carbonate, lead chromate, or gypsum; but these may be added to alter the shade when the mixture is designed for use as a pigment. A simple scheme for the analysis of Paris green for the above impurities is given."

Choice of a substance for use as a basis for standardizing solutions in acidimetry and alkalimetry, S. P. L. JÖRENSEN (*Rev. Chim. Ind. 9, No. 107, p. 304; abs. in Jour. Soc. Chem. Ind., 18 (1899), No. 1, p. 74*).—Sodium oxalate is recommended, its advantages for the purpose being pointed out. A weighed portion is ignited in a platinum crucible, and the resulting carbonate is used for standardizing normal acid by titration.

Baumé's hydrometer—American standard, S. S. EMERY (*Jour. Amer. Chem. Soc., 21 (1899), Nos 2, pp. 118–132; 4, p. 388*).—A calculation of the degrees Baumé corresponding to specific gravities of liquids lighter and heavier than water.

The quantitative determination of glucose in pure solutions and in blood, A. BICKEL (*Arch. Physiol. [Pflüger], 75 (1899), No. 3–5, pp. 248–264*).—The outcome of the study was that in the quantitative analysis of dextrose, whether in aqueous solutions or aqueous extracts of animal tissue, an alkaline solution containing glucose should never be heated to a high temperature on account of the danger of losing a part of the dextrose by the decomposition due to the alkaline salts in the solution. An acid reaction prevents this decomposition.

The quantitative determination of glycogen, J. WEIDENBAUM (*Arch. Physiol. [Pflüger], 75 (1899), No. 3–5, pp. 113–119*).

The determination of glycogen according to Brücke and Külz, E. PFLÜGER (*Arch. Physiol. [Pflüger], 75 (1899), No. 3–5, pp. 120–247*).—It was found that the method involved an error of from 16 to 20 per cent. An attempt to make the method more exact was unsuccessful.

Determination of mustard oil in rape-seed cakes, V. STEIN (*Tidsskr. Landökon., 17 (1898), No. 7–8, pp. 503–510*).

Estimation of nicotin in tobacco, R. HEFELMANN (*Pharm. Centralhalle, 19 (1898), pp. 523, 524; abs. in Chem. Centbl., 1898, II, pp. 562, 563; Jour. Chem. Soc. [London], 76 (1899), No. 437, II, p. 261*).

Estimation of the bitter principles in hops, C. J. LINTNER (*Ztschr. Gesam. Brauw., 21 (1898), pp. 407, 410; abs. in Chem. Centbl., 1898, II, pp. 684, 685; Jour. Chem. Soc. [London], 76 (1899), No. 437, II, p. 264*).

Analysis of sumac, M. SPICA (*Leipzig Färber u. Zeugdr. Ztg., 47 (1898), p. 526; abs. in Bul. Assoc. Belge Chim., 13 (1899), No. 3, p. 154*).

The sumac of Sicily and its adulterants, F. ANDREASCH (*Gerber, 24 (1898), pp. 139, 151, 164, 176, 190, 201, 215; abs. in Bul. Assoc. Belge Chim., 13 (1899), No. 3, p. 158*).

A new method of quantitatively or qualitatively examining albuminoids, diastases, alkaloids, leucomains, or toxins, particularly those in urine, P. CHIBRET (*Compt. Rend. Acad. Sci. Paris, 128 (1899), No. 7, pp. 431–433*).

A method for distinguishing between cotton-seed, sesame, peanut, and olive oils, M. TORTELLI and R. RUGGERI (*Staz. Sper. Agr. Ital., 31 (1898), No. 3, pp. 249–269*).

Notes on the arachidic and lignoceric acids of earthnut oil, and their estimation, L. ARCHBUTT (*Jour. Soc. Chem. Ind., 17 (1898), No. 12, pp. 1124–1127*).—The results obtained are applied in the detection of peanut oil in olive oil.

Colorimetric determination of iron in water, A. SEYDA-STETTIN (*Chem. Ztg., 22 (1898), No. 104, p. 1086*).

A needed modification of the determination of calcium carbonate in marls and soils, A. MAYER (*Landw. Vers. Stat., 51 (1899), No. 4–5, pp. 339, 340*).—The substitution of acetic acid (1 part of glacial acetic acid to 2 parts of water) for the hydrochloric acid usually employed is recommended. Acetic acid gives very accurate results with pure calcium carbonate in the Scheibler apparatus and possesses the advantage over hydrochloric acid of attacking but slightly iron carbonate, which is sometimes found in considerable amounts in marls and soils and which is of no value as an amendment.

Some notes on the content of volatile acids in wine, G. MORPURGO (*Oesterrr. Chem. Ztg., 2 (1899) No. 8, pp. 209–211*).

On the formation of sugar from the albumen of eggs, F. BLUMENTHAL (*Compt. Rend. Acad. Sci. Paris, 128 (1899), No. 2, pp. 117–120*).—Recent work on this subject is briefly reviewed, and experiments by the author reported. The author believes that 8 to 12 gm. of sugar may be formed from 100 gm. of albumen (from white of egg).

A simple apparatus for the determination of nitrogen by the Kjeldahl method (*Ztschr. Analyt. Chem., 38 (1899), No. 3, p. 166; abs. in Chem. Centbl., 1899, I, p. 948, fig. 1*).

Apparatus for rapid analysis of milk, G. D. MACDOUGALD (*Jour. Soc. Chem. Ind., 18 (1899), No. 3, pp. 235–238, figs. 15*).

A new attachment for the Soxhlet extractor, S. ROBERTSON (*Arch. Hyg., 30 (1897), p. 318; abs. in Ztschr. Analyt. Chem., 38 (1899), No. 1, p. 45, fig. 1*).—The substance is contained in a glass cylinder with perforated bottom, over which a filter paper can be tied. Caps fitting over the top and bottom of the cylinder are provided for use during drying and weighing.

Report of agricultural-chemical examinations for 1898, V. STEIN (*Tidsskr. Landökon., 17 (1898), No. 7–8, pp. 500–523*).—Results of analytical work done for the Royal Danish Agricultural Society in examinations of feeding stuffs, dairy products, fertilizers, etc.—F. W. WOLL.

BOTANY.

Varieties of corn, E. L. STURTEVANT (*U. S. Dept. Agr., Office of Experiment Stations Bul. 57, pp. 108, figs. 14*).—In this monograph about 800 varieties or synonyms are treated, and an attempt is made to place the nomenclature upon a sound scientific basis. The system of classification adopted brings closely related forms together and in this way a very considerable duplication of varieties is shown. The main divisions which the author follows are those described by him in the Bulletin of the Torrey Botanical Club for August, 1894 (E. S. R., 6, p. 274).

Poa fendleriana and its allies, T. A. WILLIAMS (*U. S. Dept. Agr., Division of Agrostology Circ. 10, pp. 6, fig. 1*).—The author has attempted to remove the cause of much confusion in herbaria by presenting a study of this species of grass and the numerous forms which have been confused with it. The species and varieties recognized are: *Poa longiligula*, *P. longiligula wyomingensis* var. nov., *P. longipedunculata*, *P. longipedunculata viridescens* var. nov., *P. scabriuscula* sp. nov., *P. brevipaniculata*, *P. brevipaniculata subpallida* var. nov., *P. fendleriana*, *P. fendleriana arizonica* var. nov., and *P. eatoni*.

Copper in plants, D. T. MACDOUGAL (*Bot. Gaz., 27 (1899), No. 1, pp. 68, 69, fig. 1*).—The wide distribution of copper in plants seems to be determined by the presence of the metal in the soil rather than by any selective power in the plants. It is stated that plants grown in ordinary soils may contain 30 mg. of copper to each kilogram of dry matter, while, according to Lehmann,[1] plants growing in soils rich in copper may contain as much as 560 mg. of copper per kilogram of dry matter. The author states that a specimen from a dead tree of *Quercus macrocarpa* recently examined at the University of Minnesota was found to contain slightly less than 500 mg. of copper per kilogram of dry matter. Examination of the wood showed the copper to be present in the form of finely divided reddish brown particles in the tracheides, vessels, and medullary parenchyma. It is presumed that it gained entrance to the tissues before the death of the tree, and had therefore passed through the conducting elements and been absorbed by the living cells of the medullary rays. The large amount of the substance present, the author states, supports Lehmann's conclusions that copper does not exert a marked injurious influence upon plants.

On the poisonous properties of sodium chlorid and sea water toward plants, H. COUPIN (*Rev. Gén. Bot., 10 (1898), No. 113, pp. 177–190, figs. 3*).—A series of experiments is reported in which the toxic effect of sodium chlorid and sea water toward the germination and growth of wheat, peas, vetches, lupines, maize, and *Beta maritima*, *Atriplex hastata maritima*, and *Cakile maritima* is shown. Different strengths of solution from 0.125 to 5 per cent were tested. It was found that the toxic strength of sodium chlorid solution for wheat was 1.8 per cent, peas 1.2 per cent, vetch 1.1 per cent, lupine 2.2 per cent, and maize 1.4 per cent. For plants not growing naturally near the seashore the average toxic strength of sodium chlorid solution is about 1½ per cent; for plants which naturally grow near the seashore their toleration of this salt is much higher. *Beta maritima* and *Cakile maritima* were killed by a 4 per cent solution and the *Atriplex hastata maritima* by a 5 per cent solution. These plants are able to withstand amounts of this salt in about the proportion in which it usually exists in sea water.

The effect of other solutions on these maritime plants was tested, and the toxic strength of magnesium sulphate was found to be about 3 per cent and of magnesium chlorid about 2½ per cent. These quantities are considerably in excess of the amount ordinarily found in sea water.

---

[1] Arch. Hyg., 27 (1896), p 1.

Influence of electricity upon plants, G. E. STONE (*Bot. Gaz., 27 (1899), No. 2, pp. 123, 124*).—The results of experiments based upon measurements of about 20,000 plants are briefly outlined. The more important factors indicate that electricity exerts an appreciable influence upon plants, and the application of certain strength of currents for one minute or less is sufficient to act as a stimulus. Germination and growth are both accelerated by electrical action. Plants do not respond immediately to electrical stimuli, but possess a latent period of about 25 minutes, that is, about the same as that for heliotropic and geotropic stimuli. Reaction to electrical stimuli is limited to a narrow range in the intensity of the current and is manifest either in the acceleration or retardation of metabolic activity according to the nature and strength of the current employed. There was found a minimum, optimum, cessation, and maximum stimulus, and the excitation produced by alternating currents was more marked than that produced by direct currents. The increase of stimulus necessary to produce an equally noticeable difference of perception bears a constant ratio to the total stimulus intensity which may be expressed by the ratio of 1:3.

Root tubercles upon spring and autumn grown legumes, B. D. HALSTED (*Bot. Gaz., 27 (1899), No. 2, p. 120*).—In an abstract of a paper presented before the Society for Plant Morphology and Physiology, it was shown that the ninth successive crop of wax beans upon the same plat, grown in spring, consisted of plants whose roots were abundantly supplied with nearly spherical tubercles, while the plants of the succeeding crop grown during the summer were almost without tubercles. As an explanation of this difference the author states that there was doubtless less available nitrogen in the comparatively cool earth of May than in the warmer ground of August. The denitrifying germs, being more active in midsummer, had provided a greater supply of combined nitrogen for the young plants. The spring crop, not having this abundant supply, was nitrogen hungry, and this furnished the proper condition for the abundant development of tubercles. The widely varying results which are secured in inoculation experiments, either with soil extracts or pure cultures, can probably find an explanation in this way.

Nitragin and the nodules of leguminous plants, MARIA DAWSON (*Proc. Roy. Soc. [London], 64 (1899), No. 406, pp. 167, 168*).—This paper consists of an abstract communicated to the Royal Society, in which the author states that a study of the tubercles found upon the roots of leguminous plants has led to the confirmation of the claim of the parasitic nature of both filaments and bacteroids contained in these organs. The filaments were not found to have any constant relation with the nucleus of the cells, as was represented by Beyerinck in 1888. By plasmolysis of the root hairs the infection tube is shown to have grown into the hair and does not correspond with the primordial utricle of the hair, showing that Frank was in error in regarding the tube as formed from the contents of the hair mingled with the fungus protoplasm. By staining with aniline blue and orseillin, these tubes and filaments appear to consist of strands of straight rodlets lying parallel to the longer axis of the filaments and embedded in a colorless matrix. This matrix, it is stated, does not consist of cellulose, chitin, or any form of slime. The swellings upon the filaments occur at places where the rodlets have become heaped up, and eventually burst liberating the rodlets. After liberation from the filaments they become transformed into X, V, and Y shaped bacteroids. This variety of shape does not occur when the organisms are cultivated outside of the plant on solid media, but are readily produced in a few days in liquid pea extract. By cultivating these organisms in drop cultures they seem to multiply by division into equal or sometimes slightly unequal halves. This method of division leads to the conclusion that the organisms belong to the Schizomycetes, but whether they are true bacteria or not is still undecided. The X, V, and Y shaped bacteroids when once formed appear incapable of further growth. These organisms are aerobic, and their power of fixing atmospheric nitrogen is to be further tested.

Commercial Nitragin is said to consist of minute micrococcus like bodies, straight and immovable. They multiply rapidly on gelatine media and in pea extract become converted into bacteroids. It is stated that Nitragin consists of the tubercle organism and as a result of inoculation of either seeds or soil, tubercle formation takes place. Crossing of kinds supplied for different genera and species are found quite successful within the tribe Vicieæ. Seedling peas grown in sterile tubes showed that direct infection of the young radicles and also of older roots is tolerably certain, providing the conditions under which germination occurred are maintained after infection. It is not necessary that the organism should pass through the soil in order to secure infection, and an accumulation of carbon dioxid around the roots is not a cause of failure in infection. The addition of Nitragin to soils rich in nitrates is said to be inadvisable, but a supply of it to soils poor in nitrates may result in increased yields, although better results would probably be obtained if instead of Nitragin, nitrates should be added to the soil.

Experiments with Nitragin and Alinit, A. SEMPOLOWSKI (*Deut. Landw. Presse, 26 (1899), No. 2, pp. 13, 14*).—Inoculation experiments are reported with Nitragin on lupines, serradella, horse beans, vetches, and peas; and with Alinit on oats and barley. The soil on which the experiments were conducted was a wet loam. The germination of the legumes which had received the inoculating material was hastened somewhat, while the Alinit seemed without effect in this regard. At the end of the season the plants were removed from the plats and the amounts of straw and grain and the percentage of nitrogen in the roots determined. The plats of small-leaved lupine, fodder vetch, and serradella showed considerable increases where inoculation was resorted to, while the uninoculated plats of peas, horse beans, and hairy lupine gave the best showing.

The plat of oats which had received the Alinit culture gave the best result, while with barley the uninoculated plat made the best showing.

Disordinate variations in hybrids, C. NAUDIN (*Rev. Hort.*, *70* (*1898*), *No. 21*, *pp. 509*, *510*).—The author gives the conclusions which he has arrived at after a long experience with hybrids between a considerable number of species of plants. The conclusions are in part as follows:

The more nearly congeneric species resemble each other, the more certain and easy is their hybridization. The resemblances, however, are physiological and do not always appear in external characters. Certain plants which are very different in general appearance cross very readily and produce fertile hybrids. This is the case with *Linaria vulgaris*, a plant having large yellow flowers, and *L. purpurea*, which has small dark-purple flowers. This is also true of *Nicotiana tabacum* and *N. glauca;* the first an annual with large leaves and pink flowers and the second a small tree with comparatively small leaves and small yellow flowers. That external resemblances are not a sure indication of physiological affinities is well shown in the case of squashes. *Cucurbita maxima*, *C. pepo*, and *C. moschata*, in spite of their great resemblances in habit, foliage, and flowers, do not hybridize, while *C. melanosperma*, though very different from the other species of the genus, is influenced by their pollen and produces fruits which, however, contain seeds with imperfect embryos.

Either from imperfections of the ovules, or more frequently of the pollen, or of both these, hybrids are often sterile, but as a compensation for this inferiority they are often larger and apparently more vigorous than the parent species.

The sterility of hybrids is far from general. A considerable number of them are in some degree fertile to their own pollen and more certainly so to the pollen of one or other of the parent species. Moreover, some are as fertile with themselves as are the parent species. External resemblances of the species do not warrant a conjecture as to the degree of fertility of their hybrids.

There is some truth in statements commonly made that hybrids soon revert to the specific types from which they came, or become extinct on account of the increasing imperfection of their reproductive organs, but the exceptions are numerous. In experiments in hybridization the successive generations were watched for many years. In the first generation, that which results directly from hybridization, the product is in general very uniform, the dissimilarity of the individuals not being very marked. The majority are intermediate beween the two parent species, some inclining more than others toward one of the two species. In the second generation the case is wholly different, the rule being dissimilarity. Among 100 individuals, possibly a dozen approach more or less to the parent species without reverting entirely.

The remainder are an aggregation of anomalous forms, no two of which are alike. This capriciousness resulting from hybridization the author terms disordinate variation (*variation désordonnée*).

Report on botanical survey in Alaska in 1898, W. H. EVANS (*U. S. Dept. Agr., Office of Experiment Stations Bul. 62, pp. 48–50*).—Brief popular notes are given on a collecting tour in the Cook Inlet region during the summer of 1898, and statements are made relative to various plants of economic value.

Grasses, clovers, forage, and economic crops, W. R. DODSON and W. C. STUBBS (*Louisiana Stas. Bul. 53, 2. ser., pp. 55, figs. 12*).—Notes are given treating of grasses, leguminous forage crops, hay and forage crops other than grasses and legumes, and economic plants other than hay and forage crops. Popular descriptions are given of these different plants and suggestions given as to their relative value in the State.

New species of North American grasses (*U. S. Dept. Agr., Division of Agrostology Circ. 9, pp. 7*).—This circular consists of a description of a number of new species of grasses of which Scribner and Williams describe *Poa capillarifolia, P. saxatilis, P. brevipaniculata, P. longiligula, P. planifolia, P. limosa, P. incurva, P. invaginata*; Scribner and Smith, *Elymus arenicolus*; Scribner, *Poa leckenbyi, P. acutiglumis, P. tenerrima, P. epilis*, and *Eragrostis lutescens.*

Oogenesis in Pinus laricio, C. J. CHAMBERLAIN (*Bot. Gaz., 27 (1899), No. 4, pp. 268–280, pls. 3*).—Studies on fertilization and embryology.

Comparative anatomy of hypocotyl and epicotyl in woody plants, F. RAMALEY (*Minnesota Bot. Studies, 2. ser., 1899, pt. 2, pp. 87–136, pls. 4, figs. 23*).—The author finds these two parts of the plant essentially dissimilar, although secondary changes may cause resemblances.

Seedlings of certain woody plants, F. RAMALEY (*Minnesota Bot. Studies, 2. ser., 1899, pt. 2, pp. 69–86, pls. 4*).—A number of seedlings were studied, from which it appears that generalizations relative to the form of cotyledons can not be safely made without a great mass of data.

A contribution to the life history of Rumex, B. FINK (*Minnesota Bot. Studies, 2. ser., 1899, pt. 2, pp. 137–153, pls. 4*).—Studies are given on the life history of *Rumex salicifolius* and *R. verticillatus.*

Contribution to the biology of winter wheat, S. TOPORKOV (*Selsk. Khoz. i Lyesov., 192 (1899), Jan., pp. 1–44*).

On the biology of Agaricus velutipes, R. H. BIFFIN (*Jour. Linn. Soc. Bot. [London], 34 (1899), No. 236, pp. 147–162, pls. 3*).

Influence of the medium on the growth of roots, J. WACKER (*Jahrb. Wiss. Bot. [Pringsheim], 32 (1898), No. 1, pp. 71–116; abs. in Bot. Centbl., 75 (1898), No. 10, pp. 308–310*).

Aerial roots of the grape, V. VANNUCCINI and G. E. RASETTI (*Staz. Sper. Agr. Ital., 31 (1898), No. 4, pp. 353–359, pl. 1*).

Seed dissemination and distribution of Razoumofskya robusta, D. T. MACDOUGAL (*Minnesota Bot. Studies, 2. ser., 1899, pt. 2, pp. 169–174, pls. 2*).—The fruit of this interesting parasite of *Pinus ponderosa* is said to be explosive, and is scattered by that means. The distribution of the plant is said to be determined to a large extent by air currents rising from the bottom of canyons, the parasite being found most abundantly near the rim of the canyon.

Some appliances for the elementary study of plant physiology, W. F. GANONG (*Bot. Gaz., 27 (1899), No. 4, pp. 255–267, figs. 7*).

Variations in the starch reserve in trees at different times of the year, E. MER (*Bul. Soc. Bot. France, 3. ser., 5 (1898), No. 5, pp. 299–309*).

Investigations made on the gum flow of trees during 1898, F. LUDWIG (*Ztschr. Pflanzenkrank., 9 (1899), No. 1, pp. 10–11*).—A summary is given of some of the more important contributions published during 1898 on the gum flow of trees and its causes.

On the respiration of germinating wheat, G. BURLAKOW (*Arb. Naturf. K. Univ. Charkow, 31 (1897), Beilage, pp. I-XV; abs. in Bot. Centbl., 74 (1898), No. 11, pp. 323, 324*).

Coloring matter of flowers, P. A. KEEGAN (*Nat. Sci., 12 (1898), pp. 194-199; 14 (1899), pp. 143-149*).

Scientific and practical studies of Nitragin and Alinit with special reference to the latter, H. LAUCK (*Centbl. Bakt. u. Par., 2. Abt., 5 (1899), Nos. 1, pp. 20-23; 2, pp. 54-62; 3, pp. 87-90*).

On Alinit (*Centbl. Agr. Chem., 28 (1899), No. 3, pp. 156-165*).—A brief review of investigations on this subject.

The nitrogen problem, G. W. FIELD (*Rhode Island Sta. Bul. 50, pp. 57-62*).—This is a popular bulletin which treats of the primary chemical elements and simple nitrogenous compounds, the acquisition of nitrogen by bacteria, and the denitrifying organism.

Methods in plant histology, I, C. J. CHAMBERLAIN (*Jour. Appl. Micros., 2 (1899), No. 3, pp. 296-300, figs. 5*).

METEOROLOGY—CLIMATOLOGY.

Annual summary of meteorological observations in the United States, 1898 (*U. S. Dept. Agr., Weather Bureau, Monthly Weather Review, 26 (1898), No. 13, pp. 593-605, charts 5*).—This is a summary of observations on atmospheric pressure, temperature, precipitation, wind movement, cloudiness, and other meteorological phenomena "based essentially upon data received from about 140 regular Weather Bureau stations and 28 regular Canadian stations. The data are given in tables and charts and summarized in the text."

"The year opened with high temperature for the season east of the Rocky Mountains and cold weather in the Plateau region and on the middle and south Pacific coasts. The mild temperatures east of the Rocky Mountains continued throughout February and March, the winter being unusually mild, especially in North Dakota, the Lake region, and the Missouri and upper Mississippi valleys.

"Interlake navigation opened much earlier than usual. The Straits of Mackinac were free from ice on March 28, the earliest date but one during the 63 years that records have been kept. While navigation opened much earlier than usual, its close was marked by one of the greatest ice blockades at the west end of Lake Erie in the history of lake navigation. . . .

"There were several periods of very warm weather during July and August, the temperatures registered at a few stations east of the Appalachians being higher than ever before known. During the latter part of July and at intervals during August, periods of high temperatures, conjoined with high relative humidity, prevailed in the central and eastern portions of the country and much bodily discomfort was experienced.

"Temperature continued above normal generally until October, when a reversal of the prevailing conditions took place, such reversal being first observed in the Rocky Mountain and Plateau regions, where the temperature averaged from 1 to 4° below normal. The temperature was also below normal in October quite generally throughout the Northwest and also in the Gulf States, but remained above normal in the Lake region, the Ohio Valley, and Tennessee.

"The reversal noted as beginning in October was almost completely established during November, when the only districts showing plus departures were the Florida peninsula and the upper Lake region. In December temperature was below normal in practically all districts, the departures averaging from 1 to 8° below normal.

"The precipitation of the year just ended was below normal over by far the greater part of the United States. Fortunately, however, there was an abundance of rain generally throughout the middle portion of the central valleys and the Middle and New England States. Precipitation was below normal west of the Rocky Mountains, in the upper Mississippi and upper Missouri valleys, and from New Mexico eastward to the Atlantic. The normal precipitation over much the greater part of the last-named area, however, is more than sufficient for the needs of agricultural interests; the conditions as regards those interests were, therefore, not so unfavorable as they might otherwise have been.

"The drought which began in California in the fall of 1897 continued until May, 1898. In the latter month, which practically closes the rainy season on the Pacific coast, heavy rains fell in California and the Plateau region. The rainy season of 1898-99 in California began auspiciously, the September rains being above the average. The fall during October, November, and December, however, was below the average and at the close of the year grave apprehensions were entertained of a second season of diminished rains.

"In the Gulf and South Atlantic States the fall was below the average, although the deficiency was not so great as in former years. The precipitation of this region has been below normal with unimportant exceptions since 1890. It would be exceedingly interesting to discover the cause of the continued diminution."

Report of the Chief of the Weather Bureau, 1897-98 (*U. S. Dept. Agr., Weather Bureau Rpt. 1897-98, pp. 338, charts 38, dgms. 9*).—This report is divided into 7 parts. Part I, an administrative report, has already been noted (E. S. R., 10, p. 827). Part II gives a list of observing stations and changes therein during 1897, and hourly averages of atmospheric pressure, temperature, and wind from the records of automatic instruments at 28 stations. Part III contains monthly and annual meteorological summaries for 145 Weather Bureau stations. Part IV gives monthly and annual mean temperature and annual extremes of temperature, together with the dates of the first and last killing frost, 1897. Part V reports the monthly and annual precipitation for all stations, 1897. Part VI gives miscellaneous meteorological tables and reports, including general characteristics of the weather of 1897, temperature, precipitation, relative humidity, sunshine and cloudiness, severe local storms, loss of life by tornado and lightning, etc. Part VII contains the following articles: Climate of Cuba, Weather of Manila, and Temperature, rainfall, and humidity of San Juan, Porto Rico, by W. F. R. Phillips; Meteorological waves, and The distribution of moisture in the United States, by H. A. Hazen.

Meteorological observations, R. J. REDDING (*Georgia Sta. Bul. 41, pp. 183-185*).—A record is given of rainfall at Experiment, Georgia, during 1898, as well as of the mean temperature and rainfall at the same place for May-August, 1890-1898. The most remarkable feature of the weather during the year 1898 "was the excess of above 10 in. of rainfall over the average of the past 9 years. The total for the year was 57.24 in., and the average for 9 years was 47.05 in."

Meteorological observations at the Michigan Agricultural Experiment Station for the year 1896, R. C. KEDZIE (*Michigan Sta. Rpt. 1897, pp. 133-157*).—Daily and monthly summaries of observations during 1896 on temperature, pressure, precipitation, humidity, cloudiness, and wind movement, and a record of thunderstorms during the year.

A résumé of meteorological observations made at Châteaudun, France, during 1897, E. ROGER (*Rap. Champs D'Expériences et Démon.* [*Sta. Agron. Chartres*], *1896–97, pp. 155–161, fig. 1*).

Note of the storm in Eure-et-Loir, France, June 28, 1897, E. ROGER (*Rap. Champs D'Expériences et Démon.* [*Sta. Agron. Chartres*], *1896–97, pp. 162–170*).—A somewhat detailed account of this storm.

Sunspots and rainfall, A. B. MACDOWALL (*Nature, 59* (*1899*), *No. 1538, pp. 583, 584*).—The same method used with temperature observations noted in E. S. R., 10, p. 1020, was applied to rainfall observations extending back in case of Greenwich to 1815. The results indicate "a greater tendency to wetness in years about sun-spot minima than about maxima" in the region of Greenwich, the opposite being true for the more northerly region of Rothesay. In the author's opinion, however, this contrariety is not fatal to the idea of sun-spot influence.

Light freezes, F. SOHUT (*Prog. Agr. et Vit.* (*Ed. L'Est*), *20* (*1899*), *No. 16, pp. 485–489*).—These are discussed especially in their relation to grape growing in France.

Climate of Alaska, A. J. HENRY (*U. S. Dept. Agr., Office of Experiment Stations Bul. 62, pp. 50, 51*).—A summary of observations on temperature at different places in Alaska, which has already been published in the Monthly Weather Review (E. S. R., 9, p. 426).

The climate of Mexico in 1895, MORENO ANDA and A. GOMEZ (*Mem. y. Rev. Soc. Cient. "Antonio Alzate," 12* (*1898–99*), *No. 1–3, pp. 101–104*).

Eight years' observations on the effect of weather on vegetation. J. CLAYTON (*Paper read before the Bradford Sci. Assoc. Mar. 12, 1897*).

WATER—SOILS.

Underground waters of a portion of southeastern Nebraska, N. H. DARTON (*Water Supply and Irrig. Papers, U. S. Geol. Survey, No. 12, pp. 56, pls. 21, figs. 14*).—This is an account of field work during 1896, in which not only a detailed examination of surface geology but a careful search for all wells, both shallow and deep, was made over a district beginning in the vicinity of Lincoln, Nebraska, and extending to the vicinity of Lexington. "As far as possible, information was obtained concerning the depth of the wells, character of the strata penetrated, and the volume and quality of the water supply. . . . To a discussion of the geologic formation and their water contents is appended a statement as to the possibility of obtaining artesian water;" such facts as were procurable concerning the utilization of the available water supply in irrigation being added. "In this particular area agriculture is not regarded as dependent to any considerable extent upon the artificial application of water, but the examples cited show that in many localities irrigation on a small scale can be employed with profit."

River heights, 1896, A. P. DAVIS (*Water Supply and Irrig. Papers, U. S. Geol. Survey, No. 11, pp. 100*).—This is a series of tables giving the river heights observed and recorded during 1896 by persons employed by or cooperating with the Division of Hydrography of the U. S. Geological Survey. Tables are also appended giving data relating to evaporation, seepage, meter rating, etc. Records are given for 110 streams in 22 States—Alabama, Arizona, California, Colorado, Georgia, Idaho, Kansas, Maryland, Montana, Nebraska, Nevada, New Mexico, North Carolina, Oregon, South Carolina, Tennessee, Texas, Utah, Virginia, Washington, West Virginia, and Wyoming.

Influences of rain and the nature of the soil on the yield of forage plants, A. PAGNOUL (*Ann. Agron., 25 (1899), No. 2, pp. 83-86*).—Fescue and crimson clover were grown in pots 30 cm. deep and 7 cm. square on three different kinds of soil—sandy, clay, and calcareous. The pots were all fertilized alike with superphosphate, muriate of potash, and dried blood. One-half of the pots in each case was allowed to receive a little less water than that which fell in the open air. The other half received twice as much water. The conditions otherwise were alike. With the abundant supply of moisture the yield was about three times as great with the grass and four times as great with the clover as in case of the soils receiving the scanty supply of moisture. The relation between yields of fescue with an abundant and scanty water supply was 3.5 on clay soil, 2.7 on the sandy soil, and 2.5 on the calcareous soil. With the clover the ratios were 3.8 on the clay soil, 3.7 on the sandy soil, and 3.1 on the calcareous soil. The smallest yields were obtained on the clay soil, the largest on the sandy soil. The percentage of dry matter was smallest on the soils receiving an abundant supply of water. The percentage of nitrogen was smallest in the plants grown on clay soils. The total dry matter and the total nitrogen were largest in case of the plants receiving the largest amount of water.

Manures and hygiene, MARIÉ-DAVY (*Jour. Agr. Prat., 1899, I, No. 16, pp. 574-577*).—A discussion of the danger of contamination of underground waters by manures and the means of preventing it.

Literature of Russian soils, from 1765 to 1896, P. V. OTOTSKI (*St. Petersburg: Imperial Free Economic Society, 1898, pp. 158; rev. in Selsk. Khoz. i Lyesov., 191 (1898), Dec., pp. 711, 712*).

The condition of the soil, C. V. GAROLA (*Rap. Champs D'Expériences et Démon. [Sta. Agron. Chartres], 1894-95, pp. 91-102*).—The method of soil analysis used is described and the results of analysis of the soils of plats variously treated, examined with a view to determining the changes which they had undergone under culture, are reported.

FERTILIZERS.

The cause and significance of the decomposition of nitrates in the soil, W. KRÜGER and W. SCHNEIDEWIND (*Landw. Jahrb., 28 (1899), No. 1-2, pp. 217-252, pls. 9*).—This is an account of pot experiments by the well-known Halle method, undertaken with a view to determining whether the reduction in yield which frequently follows the application of coarse manure or straw is due to (1) unfavorable influence on the texture of the soil, (2) the addition of organisms which decompose nitrates, or (3) the addition of substances which favor the growth and development of denitrifying organisms already present in the soil.

The results with a number of crops under a variety of conditions are reported in detail and are summarized as follows:

The reduction in yield was not due to the unfavorable influence of the manure and straw on the mechanical condition of the soils, since no reduction occurred when a sufficient amount of nitrate was applied or when leguminous plants were grown. This conclusion was further confirmed by the fact that when finely ground straw or other substances which had little or no influence on the mechanical condition of the soil but contained the proper nourishment for the denitrifying organisms were applied, the decrease in yield was as marked as in the other experiments. The reduction in yield, therefore, was clearly due to the action of denitrifying organisms, but the experiments indicate that the increased activity of denitrification in the soil was not due to the organisms applied in the manure and straw, but to the fact that these substances furnished a favorable medium for the growth and development of the organisms already in the soil.

It was found that the pentosans, which are very abundant in coarse manure and straw, furnished a very available source of carbon for these organisms, being much better suited to this purpose than cellulose or fiber. Neither of these, however, furnished as favorable a medium as the more readily decomposable carbon compounds, such as glycerin, citric acid, lactic acid, etc.

No denitrification was observed in soils to which peat was added. Intensive cultivation of the soil had no effect in checking denitrification, and neither was it affected by the stand of the crop.

When the moisture exceeded certain limits it promoted denitrification. Variations in the moisture within the usual limits, however, had little influence upon the process.

The factors which exerted the greatest influence upon denitrification were temperature and the mechanical condition of the material which furnished the food for the organisms. In view of the fact that the temperature of the pots was higher and the manure used was in finer condition than is usual in field experiments, it is believed that the denitrification processes were more active in the pots than in the field.

In the authors' opinion the reduction of nitrates in the field is not a matter of very great practical significance.

On denitrification processes in nature, G. MARPMANN (*Centbl. Bakt. u. Par., 2. Abt., 5 (1899), No. 2, pp. 67–70*).—The author reports experiments which go to show that the production of nitro and ammonia compounds from albuminates, urea, etc., and of nitroso compounds from nitrates is due to fermentation processes usually complex, but that the setting free of elementary nitrogen as well as sulphur is a purely chemical process due to the action of nitrites. When solutions of amid, amin, or ammonium compounds were mixed with nitrites in an Einhorn saccharometer, evolution of free nitrogen commenced at once and the nitrites rapidly disappeared, the evolution of nitrogen continuing as long as any nitrites remained. The theoretical reactions by which the nitrogen may be set free are explained.

The results have an important bearing upon the conservation of manure. If the manure is alkaline, ammonia is formed and escapes, but at the same time the conditions are favorable to the formation of nitrates. If the manure be acid the escape of ammonia is prevented, but the conditions favor the formation of nitrites and a consequent escape of free nitrogen.

The question to decide, therefore, is whether most nitrogen is lost by denitrification or by escape of ammonia. In the author's opinion the use of alkaline preservatives will result in less loss of nitrogen and is, therefore, preferable to that of acid substances in the preservation of manure.

Commercial fertilizers, J. H. STEWART and B. H. HITE (*West Virginia Sta. Bul. 53, pp. 111-142*).—This bulletin contains reports of analyses and valuations of 343 samples of commercial fertilizers representing 186 brands, the text of the West Virginia law concerning commercial fertilizers, and a table showing the quantity and value of the different classes of fertilizers sold in the State during each of the years from 1895 to 1898.

The sales of fertilizers in the State were greater in 1898 than during any previous year. As a rule, the composition of the fertilizers examined was well up to or above the guarantee. In some cases, however, the value of the samples submitted by the manufacturer was greater than that of samples of the same brand found on sale.

The valuation of Thomas slag, F. W. DAFERT and O. REITMAIR (*Die Bewerthung des Thomasschlackenmehles. Vienna, Budapest, Leipsic: A. Hartleben, 1899, pp. 25, pls. 2*).—Wagner's investigations on this subject are discussed, and experiments along the same line by the authors and others are reported.[1] From comparative tests of a number of different kinds of slag on oats by the Wagner pot method during 2 years the following conclusions are drawn: The effectiveness of Thomas slag, as measured by increase in yield of grain, increased with the total phosphoric acid present. The completeness and rapidity of the action of the slag depends upon its fineness and chemical character. The solubility of the phosphoric acid in weak acid solutions affords, within certain limits, a valuable basis for judging the quality of slag. Wagner's citrate and citric acid methods, however, are not absolutely reliable means of judging of the practical fertilizing value of Thomas slag. After testing various solvents, a 5 per cent solution of formic acid was adopted by the authors as serving this purpose best. With this solvent the phosphoric acid dissolved from both Thomas slag and mineral phosphates was less variable and somewhat higher than in case of Wagner's solvents, and, in the authors' opinion, more in accord with the actual fertilizing value of the materials. As a result of these studies it is recommended that slag should be sold on a guarantee of 90 per cent solubility of phosphoric acid in 5 per cent formic acid.

---

[1] See also Ztschr. Landw. Versuchsw. Oesterr., 1 (1898), p. 6.

The following methods of examining slag, worked out by N. von Lorenz, are proposed: For the determination of total phosphoric acid boil 10 gm. of the slag in 100 cc. of nitric acid (1.4 sp. gr.) in a half-liter flask for 15 minutes. Add 300 cc. of water, cool, fill flask to the mark, mix the solution, and filter. With 25 cc. of the filtered solution in a 200 cc. beaker mix 20 cc. of nitric acid (1.4 sp. gr.), and add immediately, and all at once, 75 cc. of concentrated molybdic solution. Allow the solution to remain quiet for 5 minutes, then stir vigorously for 1 minute. After standing 30 minutes, filter, wash the precipitate with a solution containing 5 parts of the molybdic solution in 100 of water, dissolve in 2.5 per cent ammonia, add 20 cc. of magnesia mixture (55 gm. of crystallized magnesium chlorid and 70 gm. of ammonium chlorid in 1 liter of 2.5 per cent ammonia), and proceed as usual.

The concentrated molybdic solution used in this method is prepared as follows: Dissolve 200 gm. of dry ammonium nitrate in 870 cc. of nitric acid (1.3 sp. gr.), stir until the temperature is about 10° C., and add in a small stream, with vigorous shaking, a solution of 400 gm. of pulverized ammonium molybdate dissolved in 1 liter of water. Before use, the solution should be allowed to stand for 48 hours in a light place at 20 to 30° C , and filtered.

For determining the phosphoric acid soluble in formic acid the method proposed is as follows: Moisten 5 gm. of the slag with 5 cc. of alcohol in a half liter flask, fill the flask to the mark with 5 per cent formic acid, and shake in a Wagner rotary apparatus for 30 minutes, and filter. If a rotary apparatus is not available the flask may be allowed to stand 2 hours, with frequent shaking. To 75 cc. of the filtered formic acid extract in a slender pear-shaped flask, ending at the bottom in a graduated cylinder, add 75 cc. of the concentrated molybdic solution, allow to stand 5 minutes, and then shake vigorously for ½ minute, taking precautions to wash down all of the yellow precipitate into the graduated cylinder at the bottom. Allow the flask to stand 2 hours at rest, and then compact the precipitate in the graduated cylinder by means of a special apparatus, which is arranged to pound the flask for 15 minutes on an asbestus support. From the volume of the precipitate thus obtained the percentage of phosphoric acid is calculated by a factor which is determined by analysis in advance. In a series of determinations reported by the authors this factor was found to be 7.

Potash and soda in plants, M. STAHL-SCHROEDER (*Selsk. Khoz. i Lyesov., 190 (1898), Aug., pp. 355-389; Jour. Landw., 47 (1899), No. 1, pp. 49-84*).—The chief aim of the author in these experiments, which were carried out on the farm of the Polytechnic Institute at Riga, was the investigation of the question of the possibility of partially replacing potash by soda in plants. The object, however, of the first two experiments was to gain some light on the question of the presence of soda in plants.

Field experiments.—The experiment field of 1¾ acres with a light, sandy soil was fertilized with manure for the last time in 1882. In 1889 it was divided into two equal plats and from that time plat 1 was fertilized from year to year with 533 lbs. of Thomas slag and 266.5 lbs. of kainit and plat 2 with 1,066 lbs. of Thomas slag and 533 lbs. of kainit per acre. The potash and soda content of the oat plants grown was as follows:

Potash and soda in oat plants.

	Roots.		Straw.		Grain.	
	Potash.	Soda.	Potash.	Soda.	Potash.	Soda.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
1892:						
Plat 1	0.608	....	1.933	0.069	0.580	....
Plat 2	.691	....	2.209	.122	.641	....
1893:						
Plat 1	.221	....	1.421	.149	.444	....
Plat 2	.338	....	1.593	.220	.540	....
1894:						
Plat 1	.260	....	1.584	.190	.498	0.002
Plat 2	306	....	1.751	.182	.495	.008
1895:						
Plat 1	.418	0.028	.974	.109	.394	.005
Plat 2	464	.118	1.235	.141	.443	.009
1896.						
Plat 1	.322	.082	1.796	.284	.507	.015
Plat 2	.448	.160	2.322	.302	.452	.001
1897						
Plat 1	....	....	1.928	.324	.629	.016
Plat 2	....	....	2.328	.256	.658	.016
Average of plat 1 for 6 years	366	.055	1.606	.187	.509	.009
Average of plat 2 for 6 years	.449	.139	1.906	.204	.538	.008

These experiments show that the opinion of Pagnoul that when plants receive a plentiful supply of potash in the fertilizer they do not assimilate any soda whatever is erroneous, and tend to support the view of Contejean and Guitteau that soda almost always remains in the lower parts of the plants.

Sodium is present in kainit in the form of sodium chlorid to the amount of 21 to 40 per cent. Since oats need only very small quantities of chlorin, the sodium chlorid was assimilated as a whole in very small quantity. The question arises how much sodium would be assimilated by the plants if combined with an acid which is an essential plant food. Some experiments on this question were made, which, however, were inconclusive.

Pot experiments.—In order to determine whether potash can be partly replaced in plants by soda, the following experiments were made. Peat soil deficient in potash was used. The dry matter of the soil contained 0.021 per cent of potassium oxid, 0.016 per cent of sodium oxid, 0.715 per cent of calcium oxid, 0.175 per cent of magnesium oxid, 10.943 per cent of oxids of iron and alumina, 0.430 per cent of phosphoric acid, 1.138 per cent of nitrogen, and 8.972 per cent of insoluble matter. The loss upon ignition was 76.368 per cent. Wagner's zinc vegetation pots, 20 cm. wide and 25 cm. deep, were used. The bottoms were covered with a layer of gravel 1 in. in thickness, and 4,220 gm. of the soil, corresponding to 1,118.3 gm. of dry matter, was placed in each pot. The soil was previously well mixed with 15 gm. of calcium carbonate and 13.6 gm. of superphosphate (containing 1.2 gm. of phosphoric acid). In addition, each pot received 6.84 gm. of ammonium nitrate, 0.5 gm. of magnesium sulphate, and 0.5 gm. of ammonium chlorid. Two of the 6 pots which were used for each experiment received 3.15 gm. of potassium chlorid (2 gm. K_2O), 2 received 3.8 gm. sodium chlorid (2 gm. Na_2O), and 2 neither the one nor the other of the alkalis. Peas, oats, carrots, and buckwheat were the plants experimented with.

In the experiments with peas the yields of dry matter on the pots receiving no alkali fertilizer were 9.47 and 11.51 gm., average 10.49 gm.; the yields on the 2 pots receiving potassium chlorid were 23.43 and 32.44 gm., average 27.94 gm., and the yields on the 2 pots receiving sodium chlorid were 10.65 and 11.36, average 11.01 gm. The addition of sodium chlorid resulted in an increase of 0.52 gm. of dry matter as compared with the pots which received no alkali.

Chemical analysis of the products gave the following results:

Composition of pea plants grown with and without alkalis in the fertilizer.

		Potassium oxid.	Sodium oxid	Calcium oxid.	Magnesium oxid.	Iron oxid.	Phosphoric acid.	Sulphuric acid.	Nitrogen.
	Per ct.	*Per ct*	*Per ct.*	*Per ct.*	*Per ct*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
No fertilizer	14.854	0.376	0.327	5 385	1 223	0 708	0.746	0.532	3.914
Potassium chlorid	14 653	3.243	099	2.784	534	.150	837	.523	3.865
Sodium chlorid	13 775	.448	559	4.737	1.025	.601	.731	.552	3.650

The slight increase in potash content due to sodium chlorid must be ascribed to indirect action. It is of interest to note that in the yield from the pots receiving no alkalis the lime and magnesia contents are great.

In the experiments with oats the yields of dry matter on the pots receiving no alkali fertilizer were 9.72 and 10.74 gm., average 10.23 gm.; on pots receiving potassium chlorid, 64.74 and 67.36, average 66.05 gm.; on pots receiving sodium chlorid, 13.05 and 9.26 gm., average 11.16 gm. There was an insignificant increase of yield of dry matter due to sodium chlorid. Chemical analysis of the oats gave the following results:

Composition of oat plants grown with and without alkalis in the fertilizer.

	Ash.	Potassium oxid.	Sodium oxid.	Calcium oxid.	Magnesium oxid.	Iron oxid.	Phosphoric acid.	Sulphuric acid.	Nitrogen.
	Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct*	*Per ct.*	*Per ct*	*Per ct.*
No fertilizer	11.680	0.278	0.469	3.457	0 949	0.162	.676	0.674	2.378
Potassium chlorid	14.217	3.248	.396	1.869	1.036	172	.662	.809	1.848
Sodium chlorid	16.811	.340	3.578	1.583	.928	.144	.864	.688	2.960

The slight increase in potash where sodium chlorid was applied was probably due to indirect action. The plants from the pots receiving potassium chlorid contained large amounts of sodium oxid.

In the experiments with carrots the crop was in all cases small, in consequence of late sowing. The yields of dry matter in the leaves and roots were as follows: On the pots receiving no alkali fertilizer—leaves, 3.58 and 4.95 gm., average 4.27 gm.; roots, 4.95 and 7.82 gm., average 6.39 gm.; on the pots receiving potassium chlorid—leaves, 7.31 and 11.57 gm., average 9.44 gm.; roots, 17.76 and 25.25 gm., average 21.51 gm.; on the pots receiving sodium chlorid—leaves, 5.65 and 4.91 gm., average 5.28 gm.; roots, 5.65 and 7.23 gm., average 6.44 gm. The increase in yield due to sodium chlorid was insignificant. Chemical analysis of the leaves and roots gave the following results:

Composition of carrots grown with and without alkalis in the fertilizer.

	Ash	Potassium oxid.	Sodium oxid.	Calcium oxid.	Magnesium oxid.	Iron oxid.	Phosphoric acid.	Sulphuric acid.	Nitrogen.
	Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
No fertilizer:									
Leaves	15.727	0.665	1.897	4.585	1.130	0.501	0.541	0.477	3.298
Roots	4.625	.627	.753	.283	.284	.021	.480	.251	1.950
Potassium chlorid:									
Leaves	18.066	5.130	.313	4.523	.614	.102	.386	.769	3.190
Roots	9.079	4.101	.223	.303	.187	.159	.501	.262	2.023
Sodium chlorid									
Leaves	20.687	.824	4.752	4.464	1.070	.155	.611	.667	3.611
Roots	7.791	.939	1.927	.367	.341	.027	.728	.341	2.432

Here again there was only a slight increase in potash, corresponding to the increase in the general yield due to the sodium oxid.

In the experiments with buckwheat the yields of dry matter were as follows: On pots receiving no alkali fertilizer, 6.42 and 7.19 gm., average 6.81 gm.; pots receiving potassium chlorid, 29.46 and 21.57 gm., average 25.52 gm.; pots receiving sodium chlorid, 6.15 and 7.54 gm., average 6.85. The fertilizing with sodium chlorid gave a very insignificant increase in yield. The chemical analysis of the crop gave the following results:

Composition of buckwheat with and without alkalis in the fertilizer.

	Ash.	Potassium oxid.	Sodium.	Calcium oxid.	Magnesium oxid.	Iron oxid.	Phosphoric acid.	Sulphuric acid.	Nitrogen.
	Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
No fertilizer	12.121	0.584	0.077	3.502	1.402	1.139	1.765	0.647	4.720
Potassium chlorid	11.533	2.834	.059	2.125	.267	.714	.908	.415	3.772
Sodium chlorid	13.686	.763	.136	2.489	2.402	.358	1.382	.727	2.723

From these experiments it is clear that the formation of organic matter depended upon the minute quantities of potash, together with other fertilizing constituents present in the soil. The increase of the crop due either directly or indirectly to the introduction into the soil of sodium chlorid is scarcely worth mentioning.—P. FIREMAN.

The work of bacteria in barnyard manure (*Deut. Landw. Presse, 26 (1899), No. 26, p. 293*).—A review of the book by A. Stutzer on this subject.

Control of fertilizers during 1898, M. WEIBULL (*Tidskr. Landtmän, 20 (1899), No. 4, pp. 55–59*).

Analyses of commercial fertilizers, B. W. KILGORE ET AL. (*Mississippi Sta. Buls. 51, pp. 11; 52, pp. 18*).—These bulletins include explanations of terms used in fertilizer analyses, notes on valuation, tabulated analyses and valuations of 87 samples of fertilizers collected during December, 1898, and January and February, 1899, and guaranteed analyses of 71 brands of fertilizers registered for sale in the State.

Commercial fertilizers, W. C. STUBBS (*Louisiana Stas. Bul. 54, 2. ser., pp. 60–98*).—This bulletin gives the text of the State fertilizer law; discusses the nature and uses of various forms of nitrogenous, phosphatic, and potash fertilizers; and reports analyses of 195 samples of fertilizing materials, including ammoniated superphosphates, acid phosphates, cotton-seed meal, tankage, bone meal, dried blood, kainit, sulphate and muriate of potash, Tennessee phosphate rock, ground phosphate, boneblack, floats, slag meal, sulphate of ammonia, fish scrap, and ground shrimp refuse.

On the presence of injurious constituents in Chile saltpeter, M. WEIBULL (*Tidskr. Landtmän, 19 (1898), No. 45, pp. 801–803*).—The samples examined contained less than 1 per cent of sodium perchlorate; a complete analysis given shows 0.9 per cent of perchlorate. Nitrate of soda containing over 15 per cent of nitrogen has not been found to contain sufficient perchlorate to do any damage to crops.—F. W. WOLL.

Fertilizer experiments with Thomas slag on marshy soil, S. RHODIN (*K. Landt. Akad. Handl. Tidskr., 37 (1898), No. 5–6, pp. 285–291*).—Comparisons of Domnarfvet (Swedish) and foreign Thomas slag on barley.—F. W. WOLL.

Phosphatic fertilizers in the culture of sugar beets, MAIZIÈRES (*L'Engrais, 14 (1899), No. 16, pp. 372, 373*).—A general discussion.

FIELD CROPS.

Fertilizer, culture, and variety experiments on corn, R. J. REDDING (*Georgia Sta. Bul. 41, pp. 186–201*).—The work comprises variety and fertilizer tests and distance experiments. Similar work has been previously reported (E. S. R., 10, p. 138). The results of the experiments are given in tables.

Of 14 varieties, Bradberry Improved, Shannon Extra Early, Cocke Prolific, and Sanders Improved produced the largest yields, 33.04, 32.71, 32.23, and 31.37 bu. per acre, respectively. The results of tests of varieties during the last 7 years are given in tabular form.

A fertilizer experiment was made to determine whether corn prefers any particular form of nitrogen. The fertilizers employed were cotton-seed meal, nitrate of soda, and dried blood. These nitrogenous fertilizers were mixed with acid phosphate and muriate of potash in such proportions that all mixtures supplied equal amounts of phosphoric acid, potash, and nitrogen. The conclusion is drawn that dried blood is probably a little more effective as a source of nitrogen than nitrate of soda or cotton-seed meal, but that the cotton-seed meal is most economical.

Corn was grown in rows 4 ft. apart with single plants 2, 3, and 4 ft. apart in the row. The best results were obtained where the distance between the plants in the row was 3 ft. Other tests in spacing the plants confirmed the results of previous experiments.

General notes on corn culture are reprinted from Bulletin 34 of the station (E. S. R., 9, p. 124).

Methods and results of tillage, M. W. FULTON (*Michigan Sta. Bul. 164, pp. 79–96*).—The work here described is in continuation of experiments reported in a former bulletin (E. S. R., 10, p. 136). Experiments were made on the preparation of the soil for oats, and methods of cultivating corn. The moisture conditions on oat, corn, wheat, and clover plats were studied, and the effect of tillage on the moisture content of the soil determined. The results obtained are given in tables and discussed. The rainfall from April to October, inclusive, is reported.

Corn was grown on two series of four plats each. The soil of the first series was a sandy loam somewhat gravelly below a depth of 1 ft., while the soil of the second series was not quite so sandy at the surface and contained more clay below the first foot. In each series, plat 1 was not cultivated; plats 2 and 3 were given 3 cultivations with a weeder, 7 with a Gale cultivator, and 7 with a Planet Jr. cultivator; and plat 4 was cultivated 5 times with a Gale cultivator. The crop was cut September 10 and 12 and the yield was determined at that time. The average percentage of moisture at different depths, from June 4 to September 7, and the yields of the different plats are given in the following table:

The yields of corn and the average moisture content of soil under different methods of cultivation.

	Cultivation.	Yield of corn.		Moisture content of soil.			
		Green corn.	Dry matter.	First foot.	Second foot.	Third foot.	Average for 3 feet.
First series:		*Pounds.*	*Pounds.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Plat 1	None	2,180	723	6.16	4.70	6.66	5.84
Plat 2	Frequent, 3 in. deep	13,207	5,532	7.15	5.72	8.23	7.03
Plat 3	Frequent, 5 in. deep.	12,687	4,799	7.45	5.98	7.83	7.09
Plat 4	Ordinary, 5 in. deep	12,167	4,380	6.28	5.64	8.44	6.79
Second series:							
Plat 1	None	1,848	620	7.16	6.36	11.73	8.42
Plat 2	Frequent, 3 in. deep	12,258	4,790	8.41	6.81	12.74	9.35
Plat 3	Frequent, 5 in. deep	12,700	4,728	8.75	7.36	12.10	9.40
Plat 4	Ordinary, 5 in. deep	10,514	3,849	7.74	8.26	11.41	9.14

The corn which was not cultivated gave a very small yield and was inferior in quality. Frequent cultivation to a depth of 3 in. gave the best results.

"When the climatic conditions are normal . . . and oat ground is to be plowed before sowing it is better . . . that the plowing be done in the fall. In [these] experiments . . . there was a difference in yield of over 9 bu. per acre in favor of the plats plowed in the fall over those plowed in the spring. Rolling sandy loam for oats is indicated as a good practice whether the rolling be done before or after the oats are drilled, although the difference in yield attributable to variations in methods of preparation of the soil was small. . . .

"Wheat ground dries out very rapidly while the crop is ripening. The decrease in moisture in the upper 3 ft. was found to be 16.27 per cent within 1 week. . . . Later if the season be dry a loss of more than 15 per cent of the moisture remaining when the wheat is harvested may be expected.

"In the early spring unplowed land was found to contain more moisture than fall-plowed land adjacent. Later in the season the reverse was the case. An important saving in soil moisture was effected by early spring plowing . . . with a thorough preparation of the plowed land."

Determinations of soil moisture on a clover plat of sandy soil and an adjacent plat which had produced no crop, were made July 20. The results showed that the soil of the fallow plat contained 62.5 per cent more moisture than the clover plat.

Observations were made on the time required for a heavy rain to soak into a dry sandy soil. On July 21 1.22 in. of rain fell, and on July 26 there was a precipitation of 4.34 in. The moisture did not become normally distributed throughout the upper 3 ft. of soil until July 31.

The cost of cotton production, J. HYDE and J. L. WATKINS (*U. S. Dept. Agr., Division of Statistics Bul. 16, pp. 99*).—This bulletin gives in tabular form the average itemized cost of the production of cotton, the returns, and the net profit in each cotton-growing State or Territory; and further discusses the cost of producing cotton under different moisture, soil, and labor conditions.

Data are given to show the relation of the use of fertilizers to the cost of production and the relation of the values of lint and seed. The range of the different items which enter into the cost of production is considered, and estimates of the cost of cotton production at different periods from 1822 to the present time are given. Circulars were sent to planters living in different sections of counties producing 400 or more bales of cotton. Estimates were received from 3,846 planters, comprising land owners, renters, and share croppers, in 717 counties. Of this number of estimates 400 were rejected for various reasons.

Of the 3,335 upland plantations, 2,659 reported a profit and 676 a loss. Of 111 plantations producing sea-island cotton, 85 reported a profit and 26 a loss. From the data obtained in the estimates it was found that the average cost of producing an acre of upland and sea-island cotton in 1896 was $15.42 and $21.95 respectively. On the plantations showing a profit the cost of producing an acre of upland and sea island cotton was $15.60 and $23 02, and on the plantations reporting a loss $14.68 and $18.44, respectively. The lowest cost of producing 100 lbs. of common lint on upland plantations was found to be $5.51 in Oklahoma and the highest $6.29 in Arkansas; on sea island plantations the lowest was $11.07 in Georgia and the highest $17.89 in South Carolina; the average cost on all upland plantations being $6.03 and on all sea island plantations $13.05 per 100 lbs. Twelve estimates received from 3 counties in Texas and 1 estimate from Utah showed that the average cost of producing an acre of cotton by irrigation in 1896 was $19.92 in Texas and $40.05 in Utah.

Experiments with flax conducted by the German Agricultural Society in 1898, LEITHIGER (*Mitt. Deut. Landw. Gesell., 1899, No. 5, pp. 61-65*).—This report describes the plan, extent, and purpose of the experiments, and gives the results in tabular form. The work comprised experiments with nitrogenous fertilizers and tests of sowing flax at different rates. The results of two years' experiments show that the use of nitrate of soda and blood meal gave an increase in the yield of straw, increased the loss in retting, decreased the fiber content, and had a detrimental effect upon the quality of the fiber.

Flax sown at the rate of 181.24 lbs. per acre had a smaller loss in retting and also a smaller fiber content than flax sown at the rate of 160.57 lbs. per acre. Sowing at the rate of 212.10 lbs. per acre produced a thick stand and the crop suffered a heavier loss in retting, was lower in fiber content, and poorer in quality than flax which had a thinner stand. Sowing at the rate of 181.24 lbs. per acre is recommended for medium heavy soils in a good state of cultivation.

Culture of wheat and oats on the experimental fields at Grignon in 1898, P. P. DEHÉRAIN (*Ann. Agron., 21 (1898), No. 11, pp. 520-534*).—Three varieties of wheat—Scholley, Daltel, and Bordier—were sown on October 15 and November 6 on plats, some of which had produced potatoes and others beets the year previous. Scholley was the most productive variety in every instance. The early-sown plats and those which had grown beets the year before gave better results than those sown later or those which had yielded potatoes. A top-dressing of 200 kg. of nitrate of soda per hectare was given some of these plats in the spring, while others were left unfertilized. The results were but slightly in favor of the use of nitrate of soda. The author believes that owing to a sufficient supply of moisture during the season the conditions for nitrifying the nitrogenous matter in the soil were so favorable that the addition of the nitrate was of but little advantage. It is concluded that these results are another proof that by irrigation the outlay for nitrogenous fertilizers may be considerably diminished.

On 10 plats wheat was grown after clover, and the results show that the clover crop prepares the soil well for wheat. On these plats an application of 10,000 kg. of barnyard manure and 100 kg. of nitrate of soda per hectare was quite effective, but the application of 20,000 kg. of barnyard manure alone gave the best results. The use of 200 kg. of nitrate of soda per hectare did not show any effect. The author states that climatic conditions were more favorable to the use of barnyard manure than to the readily available nitrate.

Of 3 varieties of oats—Houdan, Salines, and Ligowo—the last mentioned gave the best results. The variety Houdan lodged about June 25, but ripened its grain.

Report on the agricultural investigations in Alaska, C. C. GEORGESON (*U. S. Dept. Agr., Office of Experiment Stations Bul. 62, pp. 7-17, pl. 1, figs. 2, map 1*).—This report is part of a bulletin constituting a second report to Congress on agriculture in Alaska. The plan and progress of agricultural investigations carried on in Alaska in 1898 are described, and the present agricultural conditions and the possibilities of their improvement are discussed. Culture tests with field crops and vegetables were carried on at Sitka and Skagway. The field crops tested were oats, barley, buckwheat, flax, and clovers. All gave returns indicating that they can be successfully grown in that region. A large number of vegetables were tested and the climate and soil proved favorable to the growth of all excepting spinach and wax beans. In some instances at Skagway the vegetable seed failed to grow or the young plants were killed by disease. The experiences in farming and gardening of settlers in various parts of the Territory are given in a series of letters.

Soil temperatures, taken at Sitka and Skagway, and the moisture and organic matter in the water-free soil, determined by Prof. M. Whitney, in soil samples taken at Sitka and Kenai are reported.

The results of this work have been reviewed in a former number (E. S. R., 10, p. 701).

Field experiments, C. D. SMITH (*Michigan Sta. Rpt. 1897, pp. 87-90*).—The results of variety tests at the experiment station with wheat, millet, corn, oats, clover, alfalfa, Kafir corn, and sorghum during the season of 1897 are here briefly summarized. Observations on these crops have been published in the station bulletins (E. S. R., 9, p. 131; 10, p. 136).

Farm crops, C. D. SMITH (*Michigan Sta. Rpt. 1897, pp. 91, 92*).—This article is a report on the cost and labor involved in the production of various crops grown at the State experiment station. The conclusions drawn from this work have been published in Bulletin 149 of the station (E. S. R., 9, p. 1081).

Forage crops in the James River Valley in 1898, E. C. CHILCOTT and R. S. ROE (*South Dakota Sta. Bul. 61, pp. 3-16, figs. 7*).—Results of previous work in this line have been published in former bulletins (E. S. R., 10, p. 629). As in other years, the crops were grown under artesian irrigation. The grass plats established in 1896 and which have survived two winters and three summers have been preserved. Brief descriptive notes of culture tests of the following forage plants are given: Clovers, *Bromus inermis*, tall meadow grass, blue joint, alfalfa, peas, oats and peas, oats and vetch, rape, millet, sand vetch, corn and cane, and several grass mixtures. "The results obtained with brome grass, alfalfa, the clovers, and some of the meadow mixtures . . . prove without a reasonable doubt that we have found cultivated grasses and leguminous plants to take the place of the native grasses."

Plants on good and poor meadows in Wurttemberg in the light of modern theories of animal nutrition, R. BRAUNGART (*Landw. Jahrb., 27 (1898) Nos. 3-4, pp. 373-502*).—This article enumerates and describes briefly the various species of grasses and other plants growing on the meadows and pasture lands in different sections of Wurttemberg. The plants are grouped according to their feeding value, and the proportion of individual plants of each species to the total number of plants on the meadows is estimated.

The seed mixtures for permanent meadows and pastures of the moor soils of the north German lowlands and their relation to the ecology of the meadows, C. A. WEBER (*Landw. Jahrb., 27 (1898), Sup. 4, pp. 451-502*).—This article classifies the meadows of this region into four different types and gives a description of each. The forage plants found on these meadows and those recommended to be sown are described and their composition given. Ten grass mixtures are suggested, and the conditions of soil and climate to which they are adapted are pointed out and cultural methods recommended.

The influence of frost on the productivity of fall-plowed land, E. WOLLNY (*Bl. Zuckerrübenbau, 6 (1899), No. 6, pp. 82–86*).—The results of investigations show that fall-plowed land, not subsequently smoothed, was greatly benefited by the action of frost during the winter.

Breeding prolific varieties, A. KIRSCHE (*Ztschr. Landw. Ver. Hessen, 1899, No. 12, pp. 145, 146*).—A popular article by a practical breeder on the subject of breeding prolific varieties of field crops.

The varieties and forms of barley, A. ATTERBERG (*Jour. Landw., 47 (1899), No. 1, pp. 1–44*).—A classification of the cultivated varieties of barley, enumerating 188 sorts and in many instances giving their origin.

Resowing clover in spring, TANCRÉ (*Fühling's Landw. Ztg., 48 (1899), No. 8, pp. 306–308*).—This article describes the methods of resowing parts of clover fields or meadows which have been injured by frost or where the plants have been killed out by other causes. Several mixtures of grasses and clovers are suggested for this purpose.

Experiments with commercial fertilizers on corn, A. CARRÉ (*Prog. Agr. et Vit. (Ed. L'Est.), 20 (1899), No. 16, pp. 495–502*).—This article is a report on cooperative experiments with commercial fertilizers on corn carried on in France. The results obtained by the different experimenters are given in tables.

Phosphatic fertilizers in their relation to the lodging of grains, L. GRANDEAU (*Jour. Agr. Prat., 1899, I, No. 14, pp. 489, 490*).—The article states that phosphatic fertilizers give good results when applied in the spring and counteract the tendency of the grains to lodge.

Investigations and experiments on hemp, M. SAMOGGIA (*Staz. Sper. Agr. Ital., 31 (1898), No. 4, pp. 417–448*).

Chemical composition of different varieties of lupines, A. SEMPOLOWSKI (*Fühling's Landw. Ztg., 48 (1899), No. 7, pp. 245, 246*).—The chemical composition of air-dry seed of 11 varieties of lupines is given in a table.

Experiments in planting potatoes at different intervals and double cropping with cabbage, H. DAUTHENAY (*Rev. Hort., 71 (1899), No. 8, pp. 182, 183*).—Potatoes in rows 60 cm. apart and plants 50 cm. in the row gave the highest yields. Double cropping with cabbage is recommended. Lists of varieties of both crops that should be planted together are given.

Potato tests in 1898, L. S. SPENCER (*Amer. Gard., 20 (1899), No. 217, p. 125*).—Report of tests of a large number of varieties of potatoes in Illinois. A list of 42 varieties that proved satisfactory is given with descriptions; also a list of varieties deemed unworthy of further trial. The following varieties never failed to produce a good crop: *Extra early.*—Acme, Early Michigan. *Second early.*—Burpee Extra Early, Early Norther. *First late.*—State of Maine, Burr No. 1. *Second late.*—Livingston Banner, Pink Gem.

Potato culture, G. BATTANCHON (*Prog. Agr. et Vit. (Ed. L'Est), 20 (1899), No. 15, pp. 460–463*).—A popular article on potato culture in France.

Hollow potatoes (*Belg. Hort. et Agr., 11 (1899), No. 8, pp. 116, 117*).—A discussion on the occurrence of hollow potatoes and its prevention.

Distances at which sugar beets should be planted, A. GUTTMANN (*Deut. Landw. Presse, 26 (1899), No. 36, p. 289*).—A popular discussion of the subject in connection with Russian sugar-beet culture. Beets planted 25 to 27 cm. apart in rows 40 cm. apart gave better results than beets grown at shorter distances.

Sugar beets in the James River Valley, E. C. CHILCOTT and R. S. ROE (*South Dakota Sta. Bul. 61, pp. 28, 29*).—A plat of sugar beets with a stand of about 70 per cent yielded over 18 tons per acre with 20.6 per cent sugar in the juice and a purity coefficient of 94.

Modern beet-seed culture, H. K. GÜNTHER (*Bl. Zuckerrübenbau, 6 (1899), No. 7, pp. 97–104*).—This article is an historical review of the development of the sugar beet and a résumé of scientific investigations in this connection. Attention is called to the need of further investigations.

Investigations on the culture of tobacco at the experiment station of the Lokhvitz Agricultural Society, P. LOMONOSOV (*Selsk. Khoz. i. Lyesov., 192 (1899), Jan., pp. 185–208*).

Farmers and fruit-growers' guide, 1898, W. H. CLARKE (*Sydney: W. A. Gullick, 1898, 3 ed., pp. 495, ill.*).—Similar in scope and contents to the second edition (E. S. R., 9, p. 298).

HORTICULTURE.

A report of progress on investigations on the fertilizer requirements of fruit trees, BARTH-COLMAR (*Gartenflora, 48 (1899), No. 5, pp. 125, 126*).—Ninety analyses of vegetative organs of fruit trees were made to determine the fertilizer requirements of each. These results were supplemented by numerous collated analyses of fruits and researches on wood, leaf, and fruit growth. From these data the formula for a fertilizer is determined, which is believed to afford a rational basis for further fertilizer experiments on fruit trees. The calculations are made for trees with tops of 5 meters diameter and spreading over perhaps 20 square meters of ground. A table shows the increase in one year in weight of dry matter in the root wood, trunk wood, branch wood, leaves, and fruit of one such cherry, plum, apple, and pear tree, respectively. Another table shows the average percentage of nitrogen, potash, phosphoric acid, and lime in the several parts of pomaceous and drupaceous fruits. From these tables are estimated the fertilizer requirements for 1 square meter actually covered by tree tops:

The fertilizer requirements of certain fruit trees per square meter of area actually covered by tree tops.

	Nitrogen.	Potash.	Phosphoric acid.	Lime.
	Grams.	*Grams*	*Grams*	*Grams.*
Cherry	11.3	15.95	3.1	21.05
Peach	7.0	10.63	2.3	8.42
Apple	7.1	7.30	1.5	9.80
Pear	7.5	10.90	2.1	6.70

From these figures the following formula for 1 square meter of ground covered is derived: 10 gm. nitrogen, 15 gm. potash, 5 gm. phosphoric acid, and 20 gm. lime. The large proportion of potash in this formula is necessitated by the extensive leaf development of the cherry. The proportion of phosphoric acid in the mixture is greater than the yearly requirements of the plants on account of its slow availability in the soil, at least the first few seasons. It was found that in general in all fruit trees the proportion of plastic substance to the total dry matter gradually increased from the root wood through the stem wood and twig wood to the leaves. The proportion of nitrogen in all woody parts of the tree is greater than that of any other food element excepting lime, but in the leaves there is less nitrogen than potash, and this difference is still greater in the fruit. The woody parts of drupaceous trees are poorer in lime than are pomaceous trees, but the leaf is richer. This last statement is true also of the fruit, although in this case the difference is not so great. In the pits of cherries and plums nitrogen is much in excess of the ash, of which latter phosphoric acid forms the larger part. The results obtained in these experiments furnish additional evidence of the importance of potash in the production of sugar in the plant.

Olives, F. T. Bioletti and G. E. Colby (*California Sta. Bul. 123, pp. 35, figs. 7, pl. 1*).—This bulletin is intended to be a convenient summary of such practical information in regard to olive culture as is most in demand. Under the head of cultivation are discussed climate, soil, propagation, pruning, grafting, budding, and gathering the fruit. Under oil making are considered drying and crushing, the separation of the oil, and pressing and clarification. Under pickling are discussed the lye process, pure-water process, manufacture of green pickles, nutritive value of olives, and grading and sorting. A number of the best-known varieties are described and notes are given on the twig borer, black scale, sooty mold, peacock leaf-spot, dry rot, bacterial rot, and olive knot.

Investigations were made on the comparative value of ripe and green pickled olives as foods. Analyses are shown in the following table:

Analyses of edible part of ripe and green pickled olives.

	Ripe olives from California.			Green Queen olives from Spain.
	Medium sized Mission.		Larger Watery Mission.	
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*
Water	64.72	65.45	72.77	78.41
Oil	25.89	25.15	18.81	12.90
Carbohydrates	4.28	3.22	2.49	1.78
Other substances	5.11	6.18	5.93	6.91

From this table it is seen that pickled ripe olives are very nutritious, much more so than green olives. They are also said to be more assimilable.

Studies were made of variations of size of fruit and amount of pit and oil in different varieties. The ratio of the smallest to the largest fruit, the pit, and oil in the flesh in each of 15 varieties are tabulated, and the averages for each of 57 are given.

The averages for varieties of which 10 or more samples have been examined are as follows:

Average size and composition of olives by varieties.

Variety.	Number of samples examined.	Number of olives per pound.	Percentage of pit.	Percentage of oil.		
				In whole fruit.	In flesh.	In pit, referred to whole fruit.
Varieties fully tested:						
Mission	112	111.6	17.2	17.56	22.51	0.61
Nevadillo Blanco	57	157.3	17.3	19.21	22.92	.99
Manzanillo	38	106.6	14.7	16.94	19.73	.55
Redding Picholine	42	398.2	23.0	16.18	20.83	1.52
Uvaria	29	205.1	25.5	13.71	18.51	1.07
Rubra	35	196.1	17.9	18.58	22.01	.75
Oblonga	32	179.4	18.7	13.34	15.68	.85
Columbella	25	114.6	16.6	15.59	19.54	.60
Pendulina	22	157.1	13.7	18.63	21.36	.96
Varieties not yet fully tested.						
Atro-violacea	19	206.6	22.5	17.55	22.40	1.08
Præcox	15	196.1	19.2	14.34	17.75	.84
Polymorpha	14	71.9	17.1	15.85	18.82	.88
Macrocarpa	12	72.8	17.5	14.70	20.41	.70
Regalis	12	112.5	16.3	16.37	19.58	.96
Nigerina	12	160.0	17.5	19.96	26.16	1.06
Atro-rubens	11	115.4	16.9	19.14	25.59	.75
Corregiolo	11	262.7	25.8	21.15	27.68	1.24
Razzo	10	216.5	21.3	21.10	28.42	.84

It was found that the above varieties fully tested "as grown in the bay region are all of smaller size than those from any of the other regions of the State, but generally they bear the largest percentages of oil. . . . It would seem, then, that the cool bay climate does not prevent the proper functioning of the drupe in these varieties."

Hybrid plums, F. A. WAUGH (*Vermont Sta. Bul. 67, pp. 30, figs. 16*).—Hybrids have recently appeared as a new factor in the study of plums. In this bulletin the author has collected the best information obtainable regarding every hybrid of which he can learn. The importance to the science of pomology of putting these first hybrids on record is noted, as also the desirability of understanding "as well and as soon as possible the general limits, tendencies, and effects of hybridity among plums." It is believed that, aside from individual varieties, "which are mostly the intentional or unintentional products of cultivation, there are certain large groups of hybrids occurring in nature." Among such are the Wildgoose, Miner, and Wayland groups, the parentage of which the author has attempted to determine. "On purely speculative grounds we may assume that the Wildgoose group is the result of various primary crosses between the wild *Prunus americana* and *P. angustifolia*, and that the Miner group represents secondary crosses between the Wildgoose group and the Americanas. With somewhat less certainty we may assume that the Wayland group has arisen from crosses of *P. angustifolia* with the southern form of the Americana plum, *P. americana mollis*." It was found that the horticultural hybrids now known also occur in groups.

The question of what constitute trustworthy evidences of hybridity is discussed. The author opposes the commonly received opinion that hand pollination furnishes the only basis upon which hybridity may be certified. Even in cases of hand pollination it is pointed out that the results are very uncertain and that "the extrinsic characteristics of [a hybrid] are relied upon for the final proof of its parentage." It is laid down as a working principle that "for all practical, and for most scientific, purposes, intermediateness of character is the only practicable and the most reliable test of hybridity." As such the author assumes it as the sole basis of classification, which is defined to be "first of all, a systematic presentation of apparent resemblances and differences."

Proceeding from this point of view, the author abandons the natural classification of a hybrid by naming its parents and declares that "a hybrid is to be classified by referring it to the several species whose characters it exhibits." The existence of intergradient forms makes the work of hybrid-plum classification difficult. In this work 2 points must be observed: "First, one must fix in his mind certain definite types; and, second, he must group the multitudinous varieties about these types, referring them to whatever type or types they seem most to resemble."

So far as the data at hand would permit, the limits of crossing between species and of the affinities of one species for others were determined. Of 30 varieties of probable hybrid origin, 90 per cent are referred to *P. triflora.* Aside from the fact that especial efforts have been made to secure Japanese hybrids, the author considers it probable that "the Japanese plums have a special affinity for the Chickasaws and for the closely related members of the Wildgoose group." The fact is also brought out that only one hybrid is referred to *P. domestica.* The belief is expressed that the opinion for some time prevalent among fruit growers, that the Domestica plums do not cross naturally with other species and that hybrids may be produced artificially only with extreme difficulty, is probably correct. It is also believed that the Americanas have less affinity for other species than the Chickasaws, Hortulanas, or Trifloras; but it is considered settled that crosses can be effected under favorable conditions between any two species of plums. Hybridization of plums, however, is not restricted to these limits, for they have been hybridized with the cherry, peach, and apricot. It is believed that a great number of accidental hybrids will be brought to light in the next few years and that "the introduction of the hybrid plums marks an epoch in plum culture. The results promise to be even more abundant and far-reaching than those which have flowed from the hybridization of the grape." Other possibilities in plum hybridization are suggested.

The fruit of Feijoa sellowiana, E. ANDRÉ (*Rev. Hort., 71 (1899), No. 3, pp. 66, 67, figs. 2*).—Notes additional to those already given (E. S. R., 10, p. 757). This tree is still thriving in the south of France without shelter. A second year's observation has given the author occasion to modify his description of it in certain details. In 1898 about 100 fruits were obtained, which are described as follows: The largest weighed 75 gm. and was 8 cm. long and 5.6 cm. thick. The fruit is much dented, slightly and unequally furrowed, smooth at maturity, at first a deep green, becoming dark yellowish green, texture firm. The flesh is a thick, creamy yellow, of the consistency of a pear, and its flavor is suggestive of the aroma of the strawberry. It possesses a very heavy perfume.

Experiments in ringing grapevines, W. PADDOCK (*New York State Sta. Bul. 151, pp. 265–275, figs. 4, pls. 2*).—An introductory statement is made of the principles of sap movement concerned in ringing and their application in practice. Experiments were carried on for two seasons in two vineyards to test the process and its modifications. In the first vineyard the vines were trained on the two-arm Kniffin system. Both arms of most of the vines in these experiments were ringed just beyond the fifth bud, the remainder just beyond the renewal bud. In the second vineyard the vines were trained on the renewal system and the rings were made just beyond the renewal bud. The results of these experiments are given in the following résumé:

"Ringing grapevines, generally speaking, produces an earlier ripening of the fruit and larger bunches and berries.

"These results, however, depend on several factors, among which may be mentioned: Variety, season, and abundance or lack of healthy foliage, good culture or lack of it, and the amount of fruit the vine is allowed to mature.

"That some varieties suffer a loss of quality when ringed there is little doubt; other varieties do not appear to be affected in this manner by the operation. Cutting back the new growth on ringed arms appeared to result in giving better quality to the fruit.

"The process is more or less devitalizing in its effect on the vine, depending in part, at least, on the factors mentioned in the second paragraph. It has been found in practice, however, that some varieties when judiciously managed may be ringed for a number of years in succession with little injury to the vine.

"Vines grown on the renewal system would seem to be better adapted to ringing than those grown on the Kniffin plan, since with the former more wood can be left to support the vine than is possible with the latter system."

Annual flowers, G. N. LAUMAN and L. H. BAILEY (*New York Cornell Sta. Bul. 161, pp. 291–322, figs. 11*).—The primary purpose of this bulletin is to give advice as to improvement of home grounds. In any place flowers should be accessories. The author states that the main planting should be of trees and shrubs; the flowers constitute the decorations and should be planted against a background. If the motive is not so much decoration as the growing of flowers for flowers' sake, a bed may be planted, but it should be at one side of the house or in the rear and not in the middle of the lawn. Many annual plants make effective screens, as morning glories and other climbers. Cultural directions for growing annuals are given. A table gives a list of 459 flowering annuals successfully grown at Ithaca in 1897 and 1898 under usual conditions of culture. There are also given the dates of first bloom, full bloom, and last bloom at the station, together with height, habit, color, and other remarks. It is hoped that these statistics may also be useful to florists, catalogue makers, and others particularly interested in this class of plants. The following groups are specially mentioned as staple or general-purpose types: Petunias, phloxes, pinks or dianthuses, larkspurs or delphiniums, calliopsis or coreopsis, pot marigold or calendula, bachelor's button or *Centaurea cyanus*, clarkias, zinnias, marigolds or tagetes, collinsias, gilias, California poppies or eschscholtzias, verbenas, poppies, China asters, sweet peas, nemophilas, portulacas, silenes, candytufts or iberis, alyssum, stocks or matthiolas, morning-glories, nasturtiums or tropæolums.

Hints on rural school grounds, L. H. Bailey (*New York Cornell Sta. Bul. 160, pp. 271-290, figs. 17*).—This bulletin is a first move on the part of the station toward the solution of the problem of the improvement of rural school grounds, which are stigmatized as being on the average "bare, harsh, cheerless, immodest." In beginning a reform, the plan of the place is of the utmost importance. First determine definitely the general outline and fill in details afterwards. "Begin with the plan, not the plants."

The place "should be hollow, well planted on the sides, open in the interior. The side next the highway should contain little planting. The place should be a picture, not a mere collection of trees and bushes." Mass plantings and focus attention; the nursery style of scattering trees over the lawn only distributes it. Suggestions are given on how to start a reform and how to make improvements. Notes are given on making the sod, how to make a border plan, the amount of plants for the main planting, and the kinds of plants for decoration.

Report of the horticulturist, L. R. Taft (*Michigan Sta. Rpt. 1897, pp. 92-95*).—Notes are given on the station orchard, small fruits, vegetable gardening, and spraying. Apples were almost a total failure. Among cherries Brusseler Braune, Wragg, and Ville Sweet are regarded as particularly promising, and notes are given on these varieties. Among the most promising Japan plums are Abundance, Burbank, Red June, Satsuma, and Wickson; and among strawberries may be mentioned Ruby, Glen Mary, and Ideal. Unfavorable notes are given on the strawberry-raspberry which is stated to be a wild Japanese variety of raspberry and not a hybrid. As in previous years, all the most promising novelties have been tested in the vegetable garden.

Fruit raising as an industry in the United States of North America, J. Nyemyetz (*Rpt. Min. Agr. and Imp. Domains, Dept. Agr. St. Petersburg, 1898, pp. XV+388, figs. 222, map 1; rev. in Selsk. Khoz. i Lyesov., 191 (1898), Oct., pp. 226-228*).

The construction of greenhouse benches for subwatering, W. J. Green (*Florists' Exchange, 11 (1899), No. 16, p. 140*).—A summary of work on this problem at the Ohio Station since 1890.

A new method of watering grapes, fruit trees, and ornamental trees and shrubs, P. Andieu (*Prog. Agr. et Vit., 16 (1899), No. 17, pp. 513-518, fig. 1*).—The method consists in sinking a large cylinder or inverted funnel at the base of the plant. Where water is scarce, a great saving is effected by this means.

Principles of pruning shrubs, C. Baltet and Charguerand (*Florists' Exchange, 11 (1899), No. 17, pp. 470, 471*).—This article includes Baltet's tables.

Coffee pruning (*Jour. Jamaica Agr. Soc., 3 (1899), No. 4, pp. 207-209*).

What is the best season for planting cuttings of trees and shrubs in the nursery? PEPIN (*Belg. Hort. et Agr., 11 (1899), No. 7, pp. 99, 100*).—Contrary to the usual practice the writer plants cuttings of hardy trees and shrubs in the fall. The percentage of loss is less than when planted in the spring and the results far more satisfactory. The author's method of treating cuttings is described.

Celery as a vegetable, G. WYTHES (*Garden, 55 (1899), No. 1433, p. 309*).—Cultural directions, which differ somewhat from those for celery grown as a salad.

A new cucurbit, V. DAVIN (*Rev. Cult. Coloniales, 4 (1899), No. 20, pp. 19-21, fig. 1*).—Notes on a vegetable recently introduced into France It is believed to be descended from *Cucurbita pepo* and to come from Chile. It is a twining plant with large, yellow flowers and pyriform fruit. It is easy of culture, producing abundantly and is valuable as a food. It may be prepared for the table in numerous ways. It has a flavor much like the sweet potato.

Forcing rhubarb, C. CHEVALIER (*Belg. Hort. et Agr., 11 (1899), No. 8, p. 117*).—A method for forcing rhubarb is described. Early Tobolsk is considered the best forcing variety.

Garden crops in the James River Valley, E. C. CHILCOTT and R. S. ROE (*South Dakota Sta. Bul. 61, pp. 16-28, pls. 2*).—These are a continuation of tests already reported (E. S. R., 10, p. 639). Notes are given on onions, tomatoes, cabbage, cauliflower, beets, mangos, carrots, parsnips, salsify, turnips, radishes, lettuce, peas, beans, eggplant, melons, squash, pumpkins, cucumbers, and celery. On account of unfavorable circumstances, many of the yields were small.

Vanilla culture as practiced in the Seychelles Islands, S. J. GALBRAITH (*U. S. Dept. Agr., Division of Botany Bul. 21, pp. 24, figs. 4*).—This bulletin gives the general conditions of vanilla culture as practiced in the Seychelles Islands and gives directions for starting a vanillery, for preparing the vines, for cropping, pollination of the flowers, curing, and marketing the crop.

Apple tree roots and stocks (*Gard. Chron., 3. ser., 25 (1899), No. 641, pp. 264, 265; Amer. Gard., 20 (1899), No. 229, pp. 347, 348*).—A suggestive article for the experimental horticulturist, emphasizing the incompleteness of our knowledge of the root systems of trees and influence of stocks.

About 50 varieties of apples were worked on a dozen presumably different stocks. The stocks apparently exerted an influence upon the growth of the top for the first few years. Later, however, the top became sufficiently vigorous not only to neutralize the power of the stock, but seemingly even to modify the root growth.

Eighteen named sorts of stocks for the apple, representing, however, only 8 distinct varieties, were grafted with Blenheim Orange. A record was made of the number of blossoms appearing on each tree for 4 years after blossoming. Considerable differences were observed, but the disparity was as great between the results from the stocks of the same as different varieties.

Studies on the chemical composition of different varieties of apples and pears, R. OTTO (*Gartenflora, 48 (1899), No. 9, pp. 240-247*).—Analyses are reported of 55 varieties of apples and 8 of pears that had grown under the same conditions with special reference to their comparative value in the cider and perry industries.

Peach growing in New Jersey, A. T. JORDAN (*New Jersey Stas. Bul. 133, pp. 15, pls. 2*).—A report of the present status of the peach industry in New Jersey, based upon data obtained in the fruit census of 1895. The subject matter is discussed under the following heads: Soils for peaches, injury to buds, the purchase and setting of trees, varieties, cultivation and manuring, pruning and thinning, life of an orchard, insects and diseases, picking and marketing, yields, expenses and returns. "Crawford Late, Mountain Rose, Old Mixon, Stump and Reeve Favorite are the 5 most popular of the older varieties. Of the newer varieties, Elberta, Globe, and Susquehanna are favorite sorts."

A few historical notes are also given.

Pear culture in Florida (*Florida Agr., 26 (1899), No. 19, p. 290*).—An account of a successful grower's methods.

Improvement of the persimmon, H. MARION (*Missouri Hort. Soc. Rpt. 1898, pp. 273–276*).

The evolution of the strawberry, L. H. BAILEY (*Sci. Amer. Sup., 47 (1899), No. 1206, pp. 19337, 19338*).—The author believes that the very best proofs of evolution are found in the most familiar things, although they are least often mentioned in the literature of the subject. "We have been looking so far into the past, have searched so diligently for great facts, have so urgently desired to see the missing links and have so confounded ourselves with philosophy that we have forgotten to go out and see the creation going on about us." The parental form of the garden strawberry, *Fragaria grandiflora*, itself a variety of *F. chiloensis*, is made a text on which to hang a discussion of some of the evidences of evolution.

Manual on the culture of American grapevines, P. N. STROYEV (*Rpt. Min. Agr. and Imp. Domains, Dept. Agr. St. Petersburg, 1898, pp. IV+259+VIII; rev. in Selsk. Khoz. i Lyesov., 192 (1899), Jan., p. 225*).

On the development and maturity of the vine, L. BÜRING (*Gard. and Field, 24 (1899), Nos. 10, pp. 254, 255, fig. 1; 11, p. 272*).—A general discussion of the influence of climatic conditions, latitude, altitude, mountain ranges, soil, water, moisture, and special situations.

The effects of lightning on the vine, L. RAVAZ and A. BONNET (*Prog. Agr. et Vit. (Ed. L'Est.), 20 (1899), No. 13, pp. 393–399, pl. 1*).—Extensive botanical and horticultural observations.

A study in training the vine, G. DERROUGH (*Prog. Agr. et Vit. (Ed. L'Est), 20 (1899), No. 8, pp. 237–241, figs. 36*).—Several methods of grape training with modifications are described and figured.

A new method of grafting the vine, SANNINO (*Atti e Mem. I. R. Soc. Agr. Gorizia, n. ser., 39 (1899), No. 3, pp. 52–58*).—The method is a modification of the crown graft. The scion is a section of wood bearing two buds and is cut as for splice grafting, the cut beginning just below the lower bud and on the opposite side. The stock is also prepared as for splice grafting, the scion being inserted under the bark and at the tip of the stock. The union is said to form very rapidly and without enlargement.

How ringing affects grapes, F. H. HALL and W. PADDOCK (*New York State Sta. Bul. 151, popular ed., pp. 4, figs. 4*).—A popular edition of Bulletin 151 of the station (see p. 49).

New and rare plants for alpine gardens and rockeries, H. CORREVON (*Gard. Chron., 3. ser., 23 (1898), Nos. 576, p. 28; 578, p. 50; 586, pp. 170, 171; 593, pp. 283, 284; 24 (1898), No. 612, p. 212; 25 (1899), Nos. 634, p. 100; 635, pp. 117, 118*).—Horticultural notes on a large number of species.

The present condition of bulb culture in Bermuda, A. F. WOODS (*Florists' Exchange, 11 (1899), No. 18, p. 494*).

Third supplement to the descriptive list of chrysanthemums for winter blooming, O. DE MEULENAERE (*Troisième supplément à la liste descriptive des chrysanthèmes d'hiver. Gand: Ad. Hoste, 1898, pp. 36*).

Bigeneric orchid hybrids (*Garden, 55 (1899), No. 1431, p. 265*).—Historical notes.

Curiosities of orchid breeding, C. C. HURST (*Gard. Chron., 3. ser., 25 (1899), No. 628, p. 14*).—A discussion of the limits of hybridization in the orchid family, the systematic status of 500 primary, 270 secondary, and 30 tertiary artificial hybrids of record, and the light that this study throws on the general subject of evolution of species by natural hybridization, which the author believes has been as yet far too little emphasized.

Grafted against own-root roses, F. R. MATHISON (*Amer. Florist, 14 (1899), No. 571, pp. 1229–1232*).

FORESTRY.

The trees of Wyoming and how to know them, A. Nelson (*Wyoming Sta. Bul. 40, pp. 59–110, figs. 27*).—The author illustrates and describes 16 genera of trees represented by 31 species. The descriptions and illustrations are of such a nature as to readily aid in the identification of the arborescent flora of the State. The list of trees of Wyoming, as given in this bulletin, contains the following species: Rock pine, limber pine, Lodgepole pine, Engelmann spruce, blue spruce, Douglas spruce, Rocky Mountain juniper, desert juniper, narrow-leaf cottonwood, lance-leaf cottonwood, common cottonwood, Balm of Gilead, aspen, almond-leaf willow, western black willow, Bebb willow, paper birch, western birch, paper leaf alder, bur oak, dwarf maple, large-tooth maple, box elder, green ash, wild plum, western chokecherry, black haw, long-spine haw, western serviceberry, silverberry, and buffalo berry.

New growth on burned areas in Colorado, C. S. Crandall (*Forester, 5 (1899), No. 1, pp. 7, 8, fig. 1*).—After mentioning the very slow manner in which forest areas that have been burned over are reforested, the author calls particular attention to two regions which have been investigated by him to some extent. The first is a tract in the Cache la Poudre region which was burned over in the summer of 1881. Examined 13 years later, grasses were found abundant among the dead logs and there were a few shrubs and a scattering growth of pines, the largest of which was 20 in. high and 7 years old. From this it is apparent that it was 6 years after the fire before the first pine tree started.

The second region mentioned was a tract on the south and west of Chambers Lake which was burned over in 1890. The author passed through the district a month after the fire, and states that not a green thing remained. A second visit was made to the tract 4 years later, and, with the exception of a few straggling plants of grasses and sedges, no vegetation had appeared.

The author states that the common belief that northern slopes are more quickly reforested than southern ones, on account of the greater effect which the sun's rays have on the south slopes in melting the winter's snows and exhausting the soil moisture appears to be well founded. Differences are also noted in the effect of forest fires on north and south slopes, it being claimed that fires are more destructive on the south slopes.

A century of the Department of Forestry [of the Russian Ministry of Agriculture and Imperial Domains], 1798–1898 (*St. Petersburg, 1898, pp. 251; rev. in Selsk. Khoz. i Lyesov., 191 (1898), Nov., pp. 467–469*).

Report on forestry, C. D. Smith (*Michigan Sta. Rpt. 1897, p. 90*).—A brief account is given of the cooperative experiments which are being carried on between the station and the Division of Forestry of the United States Department of Agriculture. A list of the species planted is given. The object of the experiments, it is stated, is to determine what distinction, if any, could be seen in trees grown from the same variety of seed collected in different localities

Report on the Department of Forestry of the Ministry of Agriculture and Imperial Domains for 1896 (*St. Petersburg, 1897, pp. III+163+81; rev. in Selsk. Khoz. i Lyesov., 191 (1898), Nov., pp. 466, 467*).—The gross income from the exploitation of the government forests for the fiscal year was 33,700,000 rubles (about $13,480,000), and the net income 26,500,000 rubles (about $10,600,000). The number of clerks and officials of the forestry department was 3,183. The forest guards numbered 30,333 men, besides 534 laborers. From the Institute of Forestry at St. Petersburg 63 persons graduated. The number of students in January, 1897, was 402. The expenditures of the institute were 166,500 rubles (about $66,600). In 23 lower schools there were 350 pupils. The maintenance of these schools costs 91,000 rubles (about $37,600).—P. FIREMAN.

SEEDS.

Seed examination, C. F. WHEELER (*Michigan Sta. Rpt. 1897, pp. 98, 99*).—The author gives a list of weed seeds found in 2 lots of seed imported from Europe. All the weed seeds are said to be of Old World species. Those found in the crimson clover were: *Lepidium campestre*, *Lychnis vespertina*, white mustard, charlock, kidney vetch, corn chamomile, chess, quack grass, common storksbill, and summer rape.

Similar examinations were made of the weed seed found in orchard grass imported from France. The weed seeds present were: *Brassica monensis*, *Arabis perfoliata*, wild candytuft, false flax, bladder campion, *Lychnis vespertina*, geranium, yellow melilot, black medick, Norway cinquefoil, Canada thistle, burdock, ox-eye daisy, *Leucanthemum maxium*, *Tragopogon pratensis*, *Picris hieracioides*, *Crepis bienis*, great bedstraw, caraway, rib grass, sorrel dock, common sorrel, curled dock, and velvet grass.

Seeds and low temperatures (*Science, n. ser., 8 (1898), 190, p. 215*).—It is stated that H. T. Brown and F. Escombe inclosed seeds in thin glass tubes immersed in a vacuum jacketed flask containing about 2 liters of liquid air. The air was replenished so as to subject the seeds for 110 hours to temperatures ranging from −183° C. to −192° C. The seeds used were: *Hordeum distichon*, *Avena sativa*, *Cucurbita pepo*, *Cyclanthera explodens*, *Lotus tetragonolobus*, *Pisum elatius*, *Trigonella fœnumgræcum*, *Impatiens balsamina*, *Helianthus annuus*, *Heracleum villosum*, *Convolvulus tricolor*, and *Funkia sieboldiana*. They had previously been air dried, and contained when the experiment began from 10 to 12 per cent of moisture. After their prolonged exposure to the intense cold the seeds were slowly thawed, the process requiring about 50 hours. They were then tested as to their germinative power by comparison with seeds from the same lot which had not been subjected to the low temperatures. Their germinative power showed no appreciable difference from the checks, and the resulting plants, which in most cases were grown to maturity, were equally healthy in all cases.

The authors concluded from their experiment that we must regard the protoplasm in resting seeds as existing in an absolutely inert state devoid of any trace of metabolic activity, and yet conserving the potentiality of life.

Chemical processes in the germination of seeds, F. ESCOMBE (*Sci. Progress, 7 (1898), pp. 219–236; abs. in Jour. Roy. Micros. Soc. [London], 1898, No. 5, pp. 561, 562*).—The author claims that during germination amids and amido acids perform different functions. Amids result in only small amounts from direct hydrolysis, being chiefly formed synthetically by the transformation of amido-acids and of nitrogenous substances derived from the reserve carbohydrates. The synthesis of amids takes place in the dark and the further stages of proteohydrolysis are due to enzymic action. It is claimed that protein can not be regenerated from amids in darkness, although its regeneration in the light is not proved. The author believes that the metabolism of germination is in the main chemically similar to that which occurs in mature plants.

On the change in composition which takes place during the germination of oil-bearing seed, L. MAQUENNE (*Compt. Rend. Acad. Sci. Paris, 127 (1898), No. 17, pp. 625–628; Ann. Agron., 25 (1899), No. 1, pp. 5–16*).—The question as to whether the glycerin formed from the fats present in oil-bearing seed is capable of giving rise to carbohydrates in young plants, and whether there are marked differences existing between the saturated acids and the unsaturated ones, led to a series of experiments on the germination of peanuts which contain arachidic acid and saturated acid, and castor beans which contain ricinoleic acid.

The seeds were germinated in the dark in wet sand in porcelain pots. Seedlings were analyzed at frequent intervals, and their composition is shown in tabular form. The oil content was shown to gradually decrease, but it took place more rapidly with castor beans than with peanuts. The carbohydrates, represented largely by cellulose, the ash and undetermined constituents increased in about the same proportion. The differences noted in the constituents of the plantlets is said to depend upon the chemical composition of the seed. The saturated fatty acids proved less adapted to transformation into sugar than the oleic acids. The production of carbohydrates from ricinoleic and related acids seemed to depend upon the presence in the molecules of the acids of allyl groups which by combustion are transformed into glycerin, a less polymerized and less condensed form.

Report of Danish seed control, 1897–98, O. ROSTRUP (*Copenhagen. 1898, pp. 37*).

Twenty-sixth report of the seed-control station, Copenhagen, Denmark, for 1898 (*pp. 44*).—Contains a number of articles on different kinds of seed, preparation of seed, influence of weeds on crop yield, etc.—F. W. WOLL.

Report of Gothenburg seed-control station for 1897–98, J. E. ALÉN (*Gothenburg (Sweden), 1898, pp. 15*).

Report of the seed-control station for 1897, P. BAESSLER (*Bericht über die Thätigkeit der Agr. Chem. Versuchstation und Samencontrolstation in Köslin für 1897. Köslin, 1898*).

Plant-culture trials and seed control, 1897, B. LARSEN (*Christiania, 1898, pp. 39*).—Report of the experiment station supported by the Royal Society for Norway's Weal.—F. W. WOLL.

Report of the Skara seed-control station, S. HAMMAR (*Ber. Verks. Skara Kem. Sta. och Frökontrollanst., 1898, pp. 27–31*).—The principal varieties of seed tested were oats, red clover, timothy, and fir.

Catechism of seed control, F. F. BRUIJNING (*Landbouwers-Catechismus vorr de Zaadcontrole. Wageningen: H. Van Gortel, 1898, 6. ed., pp. 48*).

Report of seed investigations fôr 1896 in Brüx, Kaaden-Duppau, Konotau, Podersam, and Saaz, A. NOWOCZEK (*Kaaden, 1898, pp. 36*).

Concerning the methods of testing agricultural seeds, D. SAKELLARIO (*Wiener Illus. Gart. Ztg., 24 (1899), No. 4, pp. 123–131, figs. 3*).—Describes the methods and apparatus adopted at the Vienna seed-control station.

Regulations concerning seed testing by the Holland seed-control station, A. F. VAN LYNDEN (*Reglement voor de Onderzoekingen aan de Rijkslandbouwproefstations. Wageningen, 1898, pp. 15*).

The results of seed tests made at Modena from 1895 to 1898, F. TODARO (*Staz. Sper. Agr. Ital., 31 (1898), No. 3, pp. 235–243*).

A new germination apparatus for beet seed, E. LALLEMANT (*Bul. Assoc. Chim. Sucr. et Distill., 16 (1899), No. 9, pp. 879, 880.*)

DISEASES OF PLANTS.

Club root and black rot of the cabbage and turnip, L. R. JONES (*Vermont Sta. Bul. 66, pp. 16, figs. 9*).—The author notes the occurrence of club root of cruciferous plants, and reviews its history and causes. Specimens received at the station in September were examined, and it was found that the parasite causing the disease had passed into the spore condition. These spores usually remain in a dormant state incased within the roots until the following spring, when they are liberated by the decay of the roots.

The different methods by which the germs are disseminated are commented upon, the principal means being in manure and with seedling plants and nursery stock. An infection is reported in Vermont which was traced apparently to infected soil adhering to celery plants brought from a region where the club root was known to exist. A list of plants affected by this disease is given and remedial measures suggested, among them the destruction by burning, burying, or cooking of all diseased material which is fed to stock, deep plowing of soil in autumn where the disease is known to be present, rotation of crops, suppression of cruciferous weeds, and the use of lime. During the past season an experiment was made in which 80 bu. of lime per acre was scattered over the soil, and cabbages and turnips planted. The cabbage plants came from two sources, one of which was known to be infested, and the other free from disease. The turnips and cabbages from clean soil showed very markedly the effect of the lime treatment, while the cabbages which came from infested soil showed little difference. This experiment is to be repeated.

The occurrence of black rot of cabbage in Vermont was reported in 1897. It has since been noted in a number of other places, but appears to be a rather recent infection. It has been previously described in Farmers' Bulletin 68 of this Department (E. S. R., 9, p. 489) and in Wisconsin Station Bulletin 65 (E. S. R., 10, p. 155).

Different types of plant diseases due to common Rhizoctonia, B. M. DUGGAR and F. C. STEWART (*Bot. Gat.*, *27* (*1899*), *No. 2*, *p. 129*).—The authors have demonstrated by experiments (1) that a damping-off of various seedlings is caused by a species of Rhizoctonia; (2) that a fungus agreeing in structure with the latter has been the cause of the serious root rot of sugar beets in New York during the past year and the fungus identified with this disease seems to be undoubtedly *Rhizoctonia betæ;* (3) and that an important stem rot of carnations is also found to be due to a fungus agreeing precisely in its characters with the beet Rhizoctonia.

It is claimed there is abundant experimental proof that the beet and carnation fungi are identical. The last-named fungi also produce damping-off, although not so abundantly as the fungus originally isolated from damping-off seedlings. Experiments indicate that these different types of disease are all due to the same species, the specific affinities of which can not as yet be given with certainty.

Notes on gum disease and crown gall, L. R. TAFT (*Michigan Sta. Rpt. 1897, pp. 96, 97*).—Reports have been received from various parts of the State of injuries to peach trees caused by development on the branches of knots from which gum exudes. An examination failed to show the presence of any specific disease, and the swellings appeared to be the result of injuries to or rupture of the bark. As a result of this injury, a corky, knot-like growth forms which, if the injuries are severe, results in weakening the branches, and where there is danger of breaking down it is advised to cut the branches back below the injured portions.

Many complaints have been received concerning the crown gall on nursery stock, particularly upon the peach. The exact nature of the disease is not known, but it is thought to be contagious, especially on soils rich in organic matter. When trees have galls upon the collar or upon the larger roots, it is claimed they should not be planted, as they will never make a desirable growth.

Additional host plants of Plasmopara cubensis, A. D. SELBY (*Bot. Gaz.*, *27* (*1899*), *No. 1*, *pp. 67, 68*).—The author reports a series of experiments conducted to ascertain the different host plants of this well known parasite of cucurbitaceous plants. There were grown, in addition to the cultivated varieties of cucumbers, muskmelons, watermelons, pumpkins, gourds, and squashes, specimens of a large number of other Cucurbitaceæ. The list of host plants determined is as follows:

"*Cucumis sativus, C. melo, C. odoratissimus, C. erinaceus, Cucurbita pepo, C. melopepo, C. verrucosa* (?), *Citrullus vulgaris, Lagenaria vulgaris, Coccinia indica, Bryonopsis laciniosa erythrocarpa, Mukia scabrella, Momordica balsamina, M. charantia, Melothria scabra, Trichosanthes colubrina, Sicyos angulatus,* and *Micrampelis* (*Echinocystis*) *lobata,* but not on *Benincasa cerifera* or *Cyclanthera explodens.*"

In every case the cucumbers and muskmelons were first attacked, after which the disease spread to other cucurbits. It is further observed that *Plasmopara cubensis* in clearly distinguishable from *P. australis*, whether examined upon the same host or upon the different hosts of the former.

Diseases of the vine, W. G. SMITH (*Gard. Chron., 3. ser., 25 (1899), No. 629, p. 17*).—The author states that the diseases of the grape may be classed into three groups—those due to parasitic fungi, those attributable to injurious insects, and those for which neither fungi nor insects offer a sufficient explanation. This last class of diseases, which is said to be due to physiological causes, is to be considered in a series of articles, the present paper dealing with shanking and blanching.

Shanking, which is a widely distributed disease, is probably the same as that described in France under the name "*maladie pectique*" and that described under the name "shelling" or "rattles" in New York Cornell Sta. Bul. 76 (E. S. R., 6, p. 732). It is characterized by the falling of the grapes as they approach maturity, the fruit breaking away where it joins the stalk, or by the fruit simply shriveling up and remaining attached. A weakened root system, excess of nitrogenous fertilizers, and possibly a deficiency in potash are thought to cause this trouble.

Blanching, or "chlorose," is recognized by the leaves becoming yellow or completely blanched, the loss of color generally beginning near the margin and spreading inward between the veins. The young twigs are frequently attacked like the leaves and dry up. The woody branches are retarded in growth and the new leaves remain small and blanched.

Experience in France seems to indicate that this disease is worst on calcareous soils. On clay or siliceous soils chlorosis only appears during cold, wet springs. The disease is said to be diminished by any mode of cultivation which promotes good drainage in the soil and strengthens the growth of the vines. Above all, applications of sulphate of iron should be applied about the roots of the grapes. Different varieties of grapes are affected to different degrees, and the subject of resistant varieties is said to be worth considering.

Plant diseases, C. F. WHEELER (*Michigan Sta. Rpt. 1897, pp. 99, 100*).—Brief notes are given on several diseases of farm crops which have not hitherto been observed on the college farm. A turnip disease, due to *Alternaria brassicæ*, became very injurious in the turnip fields of the college in August. The leaves were covered with dark-colored spots, which increased until the leaves were destroyed. Bacteria subsequently attacked the roots, causing a wet rot and the complete destruction of the crop.

A millet disease, due to *Sclerospora graminicola*, was noticed for the first time on German millet. Later the same disease was found attacking green fox-tail grass.

A lettuce disease (*Marsonia perforans*), which is confined to greenhouses, is reported as troublesome in the houses of a lettuce grower at Grand Rapids.

During the latter part of May red clover was found to be attacked by *Glœosporium* sp., the affected plants in many cases having their leaves entirely destroyed. Fully half of the plants in the clover plats were more or less affected.

The most important fungus diseases of cultivated plants, V. K. VARLIKH (*St. Petersburg, 1898, pp. X+140; rev. in Selsk. Khoz. i Lyesov., 192 (1899), Jan., p. 228*).

Pathological notes, L. SAVASTANO (*Bol. Soc. Nat. Napoli, 11, No. 11, pp. 109–127; abs. in Ztschr. Pflanzenkrank., 8 (1898), No. 6, pp. 350–353*).—Notes are given on an Opuntia rot, bacterial disease of grapes, an olive disease, rot and gummosis of Japanese medlars, canker of poplar trees, California grape disease in Sorrento, fig mildew in Campania, rot of grape stock in Sorrento, and stunting of the fruits of limes.

Concerning the diseases of the peach, C. MOHR (*Ztschr. Pflanzenkrank., 8 (1898), No. 6, pp. 344, 345*).—Notes are given on some diseases to which peach trees are subject, especially *Exoascus deformans.*

A leaf disease of olives, V. VENNUCCINI (*Bol. Ent. Agr. e Patol. Veg., 5 (1898), pp. 85–87; abs. in Ztschr. Pflanzenkrank., 8 (1898), No. 6, pp. 353, 354*).—Notes the attack of *Cycloconium oleaginum* on olive leaves. All varieties are not equally susceptible. Spraying with Bordeaux mixture is recommended as a preventive treatment.

Grape diseases in Brazil, F. NOACK (*Ztschr. Pflanzenkrank., 9 (1899), No. 1, pp. 1–10, pl. 1, figs. 4*).—Notes are given on attacks on grapes of *Peronospora viticola, Cercospora viticola, Oidium tuckeri, Glœosporium ampelophagum, Melanconium fuligineum,* root rot, a mildew caused by *Apiosporium brasiliense,* n. sp., and injuries due to wind.

Grape anthracnose in Tunis, CASIEN (*Bul. Dir. Agr. et Com., 4 (1899), No. 11, pp. 70–72*).—Notes the occurrence of the disease and recommends winter treatment with iron sulphate and summer applications of a solution of iron sulphate and lime.

Anthracnose and brunissure, F. DEBRAY (*Bul. Agr. Algérie et Tunisie; abs. in Bul. Soc. Bot. France, 3. ser., 5 (1898), No. 1, pp. 92, 93*).—Notes are given on *Sphaceloma ampelinum* and *Pseudocommis vitis.*

Concerning brunissure, DEBRAY (*Bul. Soc. Bot. France, 3. ser., 5 (1898), No. 5, pp. 253–288, pls. 2*).—A report is made of diseases of a number of plants said to be induced by *Pseudocommis vitis.*

The microparasites of wheat (*Bol. Inst. Agr. Estado de São Paulo em Campinas, 10 (1899), No. 1, p. 22*).

Culture experiments with heterœcious rusts, VII, H. KLEBAHN (*Ztschr. Pflanzenkrank., 9 (1899), No. 1, pp. 14–26, figs. [illegible]*).—Experiments are reported with *Peridermium strobi, P. pini, Melampsoridium betulinum,* and *Æcidium laricis,* and of *Pucciniastrum epilobii,* the teleutospore form of the æcidial stages on fir trees. The author makes a new genus, Melampsoridium, of those rusts having æcidia of the Peridermium type.

On the duration of the winter spores of some rusts, J. ERICKSSON (*Centbl. Bakt. u. Par., 2. Abt., 4 (1898), Nos. 9, pp. 376–388; 10, pp. 427–432; abs. in Ztschr. Pflanzenkrank., 9 (1899), No. 1, p. 49*).—The duration of the vitality of these spores is as a rule quite short, being not much more than a year. The substance of this paper has already been given (E. S. R., 10, p. 57).

Cæoma fumariæ in its genetic relationship with the Melampsora of Populus tremula, F. BUBAK (*Ztschr. Pflanzenkrank., 9 (1899), No. 1, pp. 26–29*).

Epidemics of the potato disease in Finland, G. GROTENFELT (*K. Landt. Akad. Handl. Tidskr., 37 (1898), No. 5–6, pp. 291–295, maps 4*).

The prevention of potato rot in cellars (*Ztschr. Pflanzenkrank., 9 (1899), No. 1, pp. 57, 58, fig. 1*).—Notes are given on methods for storing potatoes so as to remove some conditions for the development of rot.

On the preparation of fungicides, L. DEGRULLY (*Prog. Agr. et Vit.* (*Ed. L'Est*), *20* (*1899*), *No. 14, pp. 428–429*).—Formulas and directions for the preparation of a number of fungicides are given, including a solution in which sulphate of cadmium is substituted for copper sulphate. The latter is highly commended, although but few tests seem to have been made of it.

A new fungicide and insecticide, M. and A. CAMPAGNE (*Prog. Agr. et Vit.* (*Ed. L'Est*), *20* (*1899*), *No. 16, pp. 502, 503*).—Equal parts of alkaline turpentine and triturated copper sulphate are said to possess great value as a combined fungicide and insecticide.

Concerning some copper fungicides, L. DEGRULLY (*Prog. Agr. et Vit.* (*Ed. L'Est*), *20* (*1899*), *No. 17, pp. 511, 512*).—A formula for what is claimed to be an absolutely neutral fungicide is given as follows: Water, 100 liters; copper sulphate, 2 kg.; carbonate of soda (Solvay 90°), 350 gm.; and ammonia (22° Baumé), 1 liter. This mixture is said to be easily prepared and applied and is quite efficient.

A comparison of copper fungicides, P. SORAUER (*Ztschr. Pflanzenkrank.*, *9* (*1899*), *No. 1, pp. 55–57*).—The author quotes and comments upon the investigations of Barth-Colmar on the relative value of 16 copper fungicides recommended by the trade for the prevention of plant diseases. In tabular form are given the actual composition, cost, and real value of the fungicides.

On the fungicidal action of acetate of copper compared with sulphate of copper, A. VIGNA (*Staz. Sper. Agr. Ital.*, *31* (*1898*), *No. 12, pp. 62–69*).

On the use of powders and sprays in the treatment of fungus diseases, L. DEGRULLY (*Prog. Agr. et Vit.* (*Ed. L'Est*), *20* (*1899*), *No. 16, pp. 481–484*).—The claims relative to the merits of both forms of fungicides are reviewed, and the author concludes that for the prevention of black rot and similar diseases liquid fungicides are to be preferred.

Comparison of powdered and liquid fungicides, P. COSTE-FLORET (*Prog. Agr. et Vit.* (*Ed. L'Est*), *20* (*1899*), *No. 18, pp. 543–545*)

ENTOMOLOGY.

Report of the apiarist for 1896–97, R. L. TAYLOR (*Michigan Sta. Rpt. 1897, pp. 105–126*).—The author gives his idea of a model beehive. Besides being inexpensive, light, and simple, he recommends that certain of the sections should not be over 3 in. deep in order that they may be easily removed and replaced with empty sections and thus prevent swarming. The Aspinwall non-swarming hive gave rather good results for 2 years, but is too expensive, costing nearly 2½ times as much as the ordinary L hive. The device for the prevention of swarming is very simple. A great deal of additional room is given to the brood chamber without increasing the space, which can be occupied by comb. "This is accomplished by alternating at the approach of the swarming season all combs of the brood chamber with frames of wooden comb which has no septum and in which, consequently, nothing can be stored."

On the subject of the possible injury to grapes by bees, the author has made a number of observations, and concludes that bees never harm uninjured grapes. Of 30 varieties of grapes, with which the author experimented, he found that injury was almost entirely confined to the Delaware and Lady, which varieties are especially liable to crack open during a wet season. The bees which were observed sucking the juice from grapes with ruptured skins were noticed to work almost entirely upon compact clusters, and very seldom upon loose clusters. The author placed paper sacks around about 1,000 clusters of grapes of 13 different varieties in such a way that the bees could not gain entrance, leaving a slit in the bottom of each sack for the escape of any water which might enter. Toward the close of the experiment it was found that clusters inclosed in sacks were suffering more than those which were left uncovered, and the author concludes that the sucking away of the juice of the grapes by the bees is a direct benefit rather than an injury in that these juices are prevented from flowing upon sound grapes, and thus increasing the amount of injury by the cracking of the skin.

The author made some experiments in feeding back extracted honey after the best of the honey season was over, to determine whether unfilled combs could be in that way filled out economically. The conclusion of his experiment is that the extracted honey was fed back with a profit of nearly 62 per cent.

Experiments were tried in wintering bees in the cellar at a high temperature. During the winter the temperature seldom went below 45° F., and for the greater part of the time it ranged between 45 to 50°. The bees, which numbered 180 colonies, were put into the cellar during the first half of November. There was no unusual loss of bees until the end of February. From that time on the number of dead bees on the cellar bottom increased rapidly. The removal from the cellar was begun March 29 and was concluded April 14. Examinations disclosed the following condition: 13 colonies dead or nearly so; 2 starved; 2 dead from weakness resulting from lack of queens; one with a bottom board had apparently smothered. The dead bees from the cellar floor measured 6 well packed bushels "amounting to a loss on an average of 3 pts. of bees from each colony." During the winter there was an average consumption of honey to the amount of about 15½ lbs. per hive.

The author gives a somewhat detailed description of foul brood, and the methods of preventing it are mentioned. The method preferred by the author is that of transferring the bees to another hive and then sterilizing the old hive by heat. Honey taken from a foul brood colony was fed to another rather weak colony and the result showed that the disease had not been transmitted by this procedure. A queen from a colony affected with foul brood was introduced into another colony without infecting the second colony.

In the opinion of the author it is seldom necessary to observe any other precautions than to sterilize by heat the hive in which foul brood occurs, after removing the bees.

Supplementary report of the apiarist for the summer of 1897, J. M. RANKIN (*Michigan Sta. Rpt. 1897, pp. 127, 128*).—Two queen bees were imported from Mississippi from colonies badly infested with bee paralysis. One of the colonies into which one of the queens was introduced showed some signs of the disease, which would indicate that the disease may be introduced from the South.

In an experiment with different sorts of foundation it was found that the bees begin to work first on the drawn foundation, but later in the season they prefer the thin.

Some breeding experiments were carried on to determine the question whether the tongues of bees could be increased in length. Results were obtained which were encouraging.

Sweet potato insects, E. D. SANDERSON (*Maryland Sta. Bul. 59, pp. 129–146, pls. 13*).—The bulletin contains popular accounts of the life history, habits, and means of prevention of a number of insects which feed upon the sweet potato. The sweet potato root-borer (*Cylas formicarius*) has not yet been reported in Maryland, but sweet potato growers are warned against its possible importation. A number of cutworms attack sweet potatoes, among which *Agrotis messoria* is perhaps the most important. As remedies against this insect, the author recommends deep fall plowing, scattering bunches of grass or clover sprayed with Paris green at the rate of 1 lb. to 100 gal. of water before setting the plants, and the spreading of a poisonous mash, composed of 1 lb. of Paris green to about 2 qt. of cheap molasses and 50 lbs. of wheat bran.

The sweet potato flea beetle (*Chætocnema confinis*) is reported as being exceedingly injurious to the sweet potato in the State. The remedies suggested are the dipping of the plants before setting into a solution of arsenate of lead and the spraying of the plants after they are set out with Bordeaux mixture, which seems to be distasteful to the beetles. The arsenate of lead is to be made in the following proportion: 11 oz. of acetate of lead, 4 oz. arsenate of soda, dissolved in 100 gal. of water.

A number of tortoise beetles prey upon the sweet potato. The species mentioned are *Cassida bivittata*, *C. nigripes*, *Coptocycla bicolor*, *C. signifera*, *C. clavata*, and *Chelymorpha argus*. Brief notes are given by way of description and accounts of the habits and life histories of all these species. The remedies which are recommended are the arsenate of lead method, as described above for the flea beetle, and spraying with Paris green at the rate of ½ lb. of the poison and ½ lb. of lime to 40 gal. of water.

A species of sawfly (*Schizocerus ebenus*) is reported as sometimes attacking the sweet potato. Paris green, as recommended for the tortoise beetle, is to be used against the sawfly.

The sweet potato plume moth (*Pterophorus monodactylus*), the cucumber flea beetle, the tobacco worm, and *Macrosila cingulata* are also mentioned as enemies of the sweet potato.

The army worm and other insects, F. M. WEBSTER and C. W. MALLY (*Ohio Sta. Bul. 96, p. 26, pls. 4*).—The authors give notes on the economic importance and life history of the army worm (*Leucania unipuncta*). *Winthemia 4-pustulata* is said to be the most important parasite of the army worm in Ohio. Regarding the life history of the army worm the authors make the following statements:

> "The eggs are deposited during late April or early May, by female moths, which either passed the winter as such, or emerged in spring having wintered as pupæ. It is of course possible that larvæ might, in exceptional cases, winter over also. The worms from these eggs would develop and give rise to a second brood of moths, which, ovipositing, would produce a second brood of worms during July, this being the destructive brood of 1896. The moths developing from this second brood of larvæ, and ovipositing in August or September, would produce a third brood of larvæ, and the moths from these would constitute the first brood of moths of the following spring."

In Ohio, outbreaks of the army worm occur most frequently after cold wet springs. The natural enemies and the common artificial remedies are enumerated and described.

Occasionally species of sawflies attack wheat and various cultivated grasses. Three species of economic importance are found in Ohio, viz, *Pachynematus extensicornis*, *Dolerus arvensis*, and *D. collaris*.

There are probably three broods of the corn or bollworm (*Heliothis armigera*) per year in the southern part of the State and two in the northern. Two dipterous parasites, *Frontina armigera* and *F. frenchii*, attack the larva. Fall plowing is perhaps the best artificial remedy.

The painted hickory borer (*Cyllene pictus*) has been reared from the wood of hickory and osage orange. Strong soapsuds applied to the bark of the trees in May would doubtless destroy the eggs.

Larvæ of the raspberry cane borer (*Oberea bimaculata*) were found not only in the stems of the raspberry but also in those of apple, pear, and witch-hazel. The authors believe that the insect requires 2 years to complete its development. The destruction of old canes after berry picking is recommended as the best remedy.

An article on the peach scale (*Diaspis amygdali*) which was previously published in Canadian Entomologist, April, 1898, is reprinted.

The raspberry sawfly, and preliminary notes on the grapevine flea-beetle, V. H. LOWE (*New York State Sta. Bul. 150, pp. 219–265, pls. 7*).—The raspberry sawfly (*Monophadnus rubi*) is reported as having caused serious injury to raspberries, and to the young plants in the nurseries especially. The food plants of the insect are the raspberry, blackberry, and the dewberry. The plants suffer some injury from the laying of the eggs on the under side of the leaf. The young larvæ when hatched eat small irregular holes into the leaves, and as they become larger devour all the leaf except the midrib. They also attack the developing buds. The different stages of the insect are described. The eggs are said to hatch in from 7 to 10 days. Pupation takes place in the latter part of June. The pupal stage lasts only a few days, and there is but one brood annually. The insect is perfectly free from parasitic attacks.

The larvæ of this sawfly may be jarred or brushed from the bushes, or the ground may be cultivated in the fall so as to expose the cocoons to the heat of the sun, or the raspberries may be sprayed with arsenical compounds or with hellebore.

A bibliography of the subject is appended.

The author gives descriptions of the various stages and an account of the life history of the grapevine flea-beetle (*Haltica chalybea*). The methods recommended for combating this insect are the scattering of air slaked lime about the base of the vine, so as to kill the larvæ when they attempt to enter the ground, and spraying with arsenical poisons. The first application of Paris green should be a short time before the buds begin to swell, and should be in the proportion of 1 lb. to 50 gal. of water, with the addition of enough lime to make the mixture milky. When the larvæ first appear on the leaves, another application should be made in the proportion of 1 lb. to 150 gal. of water.

Notes on the San José scale and black peach aphis, L. R. TAFT (*Michigan Sta. Rpt. 1897, pp. 95, 96*).—During the winter of 1896 and 1897 specimens of San José scale were received from a number of sections of the State, and several centers of infection were located, all of which it is claimed were infested from nursery stock received from New Jersey. Directions were given for treatment, and the work was thoroughly done, so that further spread was to a great extent checked.

The black peach aphis is reported to have spread through a great number of orchards throughout the State, destroying thousands of trees. Various insecticides have been tested, including bisulphid of carbon, kainit, tobacco, salt, and wood ashes, and it is believed, considering its fertilizing value, that salt and wood ashes are to be recommended as the best treatment. Tobacco water is considered second best, and it is recommended that trees be soaked in tobacco water before being planted.

The San José scale, U. DAMMER (*Gard. Chron., 3. ser., 25 (1899), No. 629. p. 26*).—A review is given of a paper read by Professor Frank before the Berlin Horticultural Society on the San José scale and its allies.

On account of the somewhat prevalent belief that the *Aspidiotus conchæformis*, which is widely scattered about Europe, is but a geographical form of the American *A. perniciosus*, Frank has investigated the subject and has arrived at the conclusion that the European form is a true species, quite different from the American. In his investigations on this subject he received from America at different periods twigs of the peach densely beset with the true San José scale, and his investigations led him to conclude that instead of three generations yearly, in which a female breeds about 600 young scales, as is claimed by most American investigators, he found but one generation, and that only about 30 young are produced, from which he decides that the American theory is erroneous. He further states that it is questionable whether the San José scale can live in Europe.

Orchard fumigation, C. W. WOODWORTH (*California Sta. Bul. 122, pp. 33, figs. 22*).—The bulletin contains a history of the discovery of the insecticide value of hydrocyanic-acid gas and of its various applications for fumigating orchards. The credit for this discovery is claimed for California, the two chief workers having been D. W. Coquillett and A. D. Bishop.

The great problem in the use of hydrocyanic-acid gas is to prevent injury to the foliage, and after a long series of experiments by the gentlemen just named the present three chief features of orchard fumigation were devised, namely, the formula for the gas, the method of generating, and the night work. It was found that the foliage was much more liable to injury by fumigating during sunlight than at night.

As to the quantity of gas to use, a great variety of opinions prevail, and tables are given of the amounts used by Morse, by Coquillett during several successive experiments, by T. B. Johnson, and by W. G. Johnson of the Maryland Station, as well as by the author.

As to the tents for covering the trees, common duck canvas is used at present, most of the tents being made of 8 oz. canvas, such as is used for light sails. For making the canvas gas-tight three different methods have been tried, i. e., treating the tent with boiled linseed oil, applying sizing and paint, and saturating the canvas with a decoction of the leaves of prickly pear cactus. The latter method has certain advantages in that the canvas is not rendered stiff. A great variety of tents have been used for covering trees. The bell tent has a dome-shaped top and is manipulated by means of a derrick. The hoop tent has a rounded top and the shape of the bottom of the tent is maintained by a strong hoop of three quarter-inch gas pipe bent into circular form. The box tent has a square top and is without weights at the bottom. It is manipulated by means of a pole called a lifter. The sheet tent seems to have advantages over all the others, its only disadvantage being the fact that it possesses considerable surplus canvas. It is manipulated by means of poles and is without weights at the bottom. In manipulating these tents and in preparing the gas and charging the generator a gang of 4 or 5 men has been found most efficient; 2 or 3 men handle the tents, 1 man manages the generator and measures the acid, and the fumigator introduces the chemicals into the tent. The whole responsibility rests upon the fumigator, since it depends entirely upon his judgment as to how much of the chemicals shall be used. He has to estimate by the eye the cubical contents of the tent and say how much hydrocyanid should be used. Careful directions are given for estimating the amount of chemicals to be used from the size of the tree.

In conclusion, a bibliography is given of articles on the subject of orchard fumigation.

The effect of a slight diminution of heat during the last days of the larval stages upon the cocoons of the silkworm, F. LAMBERT (*Ann. École Nat. Agr. Montpellier, 10 (1897–98), pp. 206–220*).—A diminution of heat to the amount of 2 to 3° C. was found to prolong the larval life about 3 days and to produce an increase in the weight of the cocoons from about 7 to 8½ per cent on the average. The silk was equal and in many cases superior to that of cocoons which had been maintained at the constant temperature of 21° C.

Entomological circulars, J. B. SMITH (*New Jersey State Bd. Agr. Ent. Circs. 1–20*).—Twenty short popular circulars on the subjects of economic entomology with titles as follows: Directions for treating the tulip soft scale; Arsenical poisons and how to use them; Kerosene as an insecticide; The cottony maple scale; Whale-oil soap and its uses; How to treat the San José scale; The elm-leaf beetle; The bagworm or drop worm; The vaporer moth; Cabbage worms; Cutworms; The codling moth; Arsenate of lead; The apple borer; Lime as an insecticide; Tobacco as an insecticide; The plum curculio; Asparagus beetles; The scurfy scale; The oyster-shell bark-louse.

Fruit inspection, D. JONES (*Queensland Agr. Jour., 4 (1899), No. 3, pp. 190–193*).—Calls attention to the necessity of inspection and investigation into the best methods of eradicating insect pests.

Report of the injurious insects and plant diseases in 1898, W. M. SCHÖYEN (*Beretning om Skadinsecter og Plantesygdomme i 1898. Christiania, 1899, pp. 34, figs. 21*).—The author gives popular notes on various insect enemies of field and garden crops, shade and ornamental trees, as well as fruit trees. Among the insects noted are the frit fly, wireworms, cutworms, cabbage butterfly and cabbage-root maggot, and two species of Argyresthia, which are reported as injuring apples.

The State entomological station of Sweden, C. GRILL (*Ent. Tidskr., 19 (1898), No. 3–4, pp. 129–142*).

Report of the State entomologist of Sweden for 1897, S. LAMPA (*Ent. Tidskr., 19 (1898), No. 1, pp. 1–48, ill.*).

Principal insects injuring cabbage, Y. SHREINER (*Rpt. Min. Agr. and Imp. Domains., Dept. of Agr. St. Petersburg, 1898, pp. 32; rev. in Selsk. Khoz. i Lyesov., 192 (1899), Jan., p. 227*).

Norwegian Hymenoptera, E. STRAND (*Ent. Tidskr., 19 (1898), No. 2, pp. 71–112*).

The North American Mutillidæ, W. J. FOX (*Trans. Amer. Ent. Soc., 25 (1899), No. 4, pp. 219–300*).—This paper is in the nature of a monograph of the family and gives the principles of its classification as well as analytical tables and descriptions of new species.

The plant lice of sugar cane in Java, L. ZEHNTNER (*Meded. Proefstat. Suikerriet West Java, 38, pp. 21, pls. 2*).—Gives biologic and economic notes together with descriptions of *Aleurodes longicornis* and *A. lactea*.

The Orthopteran genus Schistocerca, S. H. SCUDDER (*Proc. Amer. Acad. Arts and Sci., 34 (1899), No. 17, pp. 441–476*).—The author gives the characters which separate this genus from Acridium, and an analytical table for determining the various species of the genus. Descriptions are given of all the species of the genus known to the author, including a number of new species.

Diagnosis of new Lepidoptera from Africa, C. AURIVILLIUS (*Ent. Tidskr., 18 (1897), No. 3–4, pp. 213–232; 19 (1898), No. 3–4, pp. 177–186*).

The frost butterfly (Cheimatobia brumata), J. PEYRON (*Ent. Tidskr., 19 (1898), No. 1, pp. 49–53*).

Two new termites from the western coast of Africa, Y. SJÖSTEDT (*Ent. Tidskr., 19 (1898), No. 3–4, pp. 204, 205*).—Preliminary communication, in German. *Termes acanthothorax* n. sp. and *T. mülleri* n. sp.—F. W. WOLL.

A new termite from Cameroon (Termes niger n. sp.), Y. SJÖSTEDT (*Ent. Tidskr., 19 (1898), No. 2, p. 128*).

Two small-fruit pests, F. H. HALL and V. H. LOWE (*New York State Sta. Bul. 150, popular ed., pp. 5, pls. 2, figs. 3*).—A popular summary of Bulletin 150 of the station (see p. 63).

The results of two years' work on the San José scale, W. B. ALWOOD (*Trans. New York State Agr. Soc., 1897, pp. 549–569*).—Soap and kerosene washes and hydrocyanic-acid gas were tried and shown to be efficient remedies.

Inspection and remedial treatment of San José scale, W. B. ALWOOD (*Virginia Sta. Bul. 79, pp. 73–94, figs. 3*).—The scale has become established at 291 points in

35 counties of the State. The infested stock came from nurseries in 13 different States. The scale was first introduced into Virginia in 1888. The remedies which the author used were "destruction of infested plants, fumigation of nursery stock, lye, soap and kerosene washes, and wax applications." The author found that pure kerosene could be safely applied through a small atomizer.

Combating insect and fungus diseases, W. M. SCHÖYEN (*Tidsskr. Norske Landbr., 5 (1898), No. 12, pp. 638–650*).

Paris green, W. C. STUBBS (*Louisiana Stas. Bul. 54, 2. ser., pp. 98–104*).—Text of the State law regulating the sale and purity of Paris green with analyses of 34 samples collected by the Commissioner of Agriculture.

A preliminary note on the cocoon fungus, H. NOMURA (*Bot. Mag. [Tokyo], 11, (1897), pp. 31–33; abs. in Ztschr. Pflanzenkrank., 8 (1898), No. 6, p. 361*).—In a brief note it is stated that silk cocoons are frequently seriously attacked by *Aspergillus flavus* and *A. glaucus*.

Concerning a fungus disease of Porthesia chrysorrhœa, G. LINDAU (*Schr. Naturf. Gesell. Danzig, n. ser., 9 (1898), No. 3–4, pp. 36, 37*).—Describes attacks of *Empusa aulicæ* on this insect and reports the possible value of this parasite in combating the destructive attacks of the insect.

FOODS—ANIMAL PRODUCTION.

Chemical examination of canned meats, H. W. WILEY (*U. S. Dept. Agr., Division of Chemistry Circ. 5, pp. 7*).—Statements are made concerning the examination of 13 samples of canned beef of different sorts. No borax, boric acid, sulphites and sulphurous acid, or salicylic and benzoic acids were found. Corned beef and luncheon beef contained small amounts of saltpeter. Common salt was also found, but the amount did not appear to be excessive. "It is a matter of common information that in the preparation of corned beef, salt and saltpeter are always used, whether it be in a large packing house or in a private family."

The appearance of the meat when the cans were opened is discussed at some length.

> "Very little fat was found in the interior. In the samples examined the whole external surface of the contents of the package presented a perfectly normal appearance; there was no indication of the action of any ferments of any kind nor any discolorations not due to natural causes.
>
> "The packages of meat having been broken in two, not cut, the fractured surface showed no gelatin and only a few patches of fat, the great mass of material consisting of the red flesh of the meat.
>
> "On opening the cans it was found in many instances that the tins on the inside were discolored and it was first considered that actual erosion had taken place. A careful microscopic examination of the surface, however, showed that this assumption was an error. In no case was the surface of the tin found to be eroded, and the discolorations were due doubtless to the natural effect of the meats upon the tin surface."

On the influence of sugar on muscle exhaustion, J. PRANTNER and R. STOWASSER (*Centbl. Innere Med., 20 (1899), No. 7, pp. 169–182, dgm. 1*).—The authors report a number of investigations, in which they were themselves the subjects, on the value of sugar as a muscle food and a protector of protein. By means of a mechanical device a weight was raised and lowered. This exercise brought into action the muscles of the upper extremities and even of the trunk and legs. Before performing the muscular work, 30 gm. of grape sugar was taken in weak tea. In control experiments an amount of dulcin equaling the sugar in sweetness was taken. The investigators did not know whether they had consumed sugar or dulcin. More work was performed when sugar was consumed than in the other cases.

A second group of experiments was made in which work was performed with Gaertner's ergostat. The subjects worked until they were thoroughly tired. The effect of sugar was then tested with work of the sort described above. In these cases the effect of sugar was very noticeable. When sugar was added to a diet which sufficed for nitrogen equilibrium, the amount of nitrogen excreted in the urine was diminished. In the author's opinion sugar is useful as a muscle food for those who have a single muscular task to perform, rather than for those who are engaged in constant, though severe, manual labor.

Danish feeding experiments with swine, 1895–1898, F. Friis (*42 Rpt. Kgl. Vet. and Landbohöjsk. Lab. Landökon. Forsög, Copenhagen, 1899, pp. 162*).—Twenty-nine experiments, which were conducted on the same general plan as the earlier investigations (E. S. R., 5, p. 428; 7, p. 242), were made during 1895–1898 with 709 pigs. They were divided into 131 lots. A number of problems were studied.

Roots for swine.—The feeding value of ruta-bagas, turnips, mangelwurzels, and grain (barley, rye, or Indian corn) was studied in 11 experiments with a total of 305 pigs.

Some of the lots were fed grain only. Others were fed a ration in which ¼ of the grain was replaced by roots, .09 to 1 lb. (dry matter) of roots being substituted per pound of grain. In all cases the liquid portion of the ration consisted of buttermilk, skim milk, and whey, alone or mixed. The average duration of the various tests was 100 days. The pigs weighed on an average at the beginning of the test 69.9 lbs. and at the end 161.8 lbs. The average daily gain per head was as follows: Lots fed grain, 0.96 lb.; lots fed Eckendorf mangelwurzels, 0.94 lb.; lots fed Bangholm ruta-bagas, 0.92 lb.; lots fed Bulloch turnips, 0.88 lb.; and lots fed Yellow Tankard turnips, 0.89 lb. The conclusion was drawn that roots may be fed as a part of the ration to pigs with satisfactory results. If a larger proportion of roots to grain had been fed, the gains doubtless would have equaled those made on exclusive grain feeding.

The dry matter and sugar content of the different kinds of roots was determined. The feeding value of the roots corresponded very nearly to their dry-matter content; the roots rich in sugar produced somewhat better results than those low in sugar, but the increase in live weight followed more closely the dry-matter content than the amount of sugar in the roots. The quality of the pork produced on the roots was excellent.

Barley vs. wheat.—Three tests with a total of 80 pigs were conducted to compare barley and wheat, 2 of these lasting 130 days and one 90 days. Either skim milk or whey was fed with the grain. The average weight of pigs at the beginning of the tests was 51.3 lbs. and at the end 183.9 lbs. The lots fed barley only gained on an average 1.09 lbs. per day, those fed wheat 1.13 lbs., and the lots fed these grains half-and-half 1.11 lbs. The wheat, therefore, produced slightly better results than barley. Similar results were obtained at the station with corn (E. S. R., 8, p. 256). The quality of the pork produced was excellent in all cases on both kinds of grain.

Molasses feed compared with barley and Indian corn.—Molasses feed was compared with barley and with Indian corn. The molasses feed was made from ½ beet molasses, ⅜ wheat bran, and ⅛ palm-nut meal, and was the same kind as used in the feeding experiments with cows at the station (E. S. R., 9, p. 275). In the 7 tests reported, 154 pigs were included. The average duration of the tests was 93 days. The average live weight of the pigs at the beginning of the tests was 73.3 lbs.; at the close, 173.4 lbs. The lots fed barley alone gained on an average 1.19 lbs. a day; those fed ½ barley and ½ molasses feed, 1.12 lbs., and those fed ½ barley and ⅝ molasses feed (the amount of molasses feed in normal ration increased by ⅛ the weight of the ration fed), 1.24 lbs. When barley was compared with a ration in which barley was replaced by molasses feed in the proportion of 1:1, the average daily gain was as follows: On barley, 1.16 lbs.; on barley and molasses feed, 1.07 lbs. When ¾ barley and ¼ molasses feed was fed, intermediate results were obtained.

Three tests, in which swine molasses feed (⅞ molasses and ⅛ palm-nut meal) and Indian corn were compared, showed that the former in every case produced smaller gains than the latter. Considering the cost of the different foods, the molasses feed produced the cheaper gain.

The results obtained in slaughter tests showed no appreciable difference in the effect of the different feeds. The pork of the animals fed molasses feed was somewhat softer than that of the barley-fed animals, while the reverse was true when corn and molasses feed were compared. It appears, therefore, according to the author, that the addition of molasses feed to a corn ration tends to improve the quality of the pork produced.

Blood-molasses feed vs. grain.—Five tests with a total of 100 pigs were made to compare blood-molasses feed with grain. The average length of the tests was 100 days. The average weight of the pigs at the beginning of the tests was 77 lbs. and at the end 169.2 lbs. The different tests were made with feeds of different origin and on somewhat different plans, but on the whole the blood molasses feed did not equal barley in feeding value when substituted for this in the ratio of

1:1. The quality of the pork of the pigs fed blood-molasses feed was generally poor. The average number for softness of pork (E. S. R., 7, p. 245) for 4 experiments was 1.9 for the grain-fed lots and 3.1 for the molasses-fed lots.

The conclusion is drawn that in the Danish (and English) market this means a loss of 1 to 2.7 cts. per pound.

Palm-nut meal vs. Indian corn.—Three tests with a total of 70 pigs were made to compare palm-nut meal and Indian corn. The average duration of the tests was 80 days. The average live weights of the pigs at the beginning was 94 lbs. and at the close 180.7 lbs. When barley was fed alone the average daily gain per head was 1.11 lbs., when $\frac{5}{6}$ corn and $\frac{1}{6}$ palm-nut meal was fed it was 1.11 lbs., with a ration of $\frac{2}{3}$ corn and $\frac{1}{3}$ palm-nut meal it was 1.13 lbs.; when corn was fed until the pigs weighed 120 lbs. and then was replaced by $\frac{3}{4}$ corn and $\frac{1}{4}$ palm-nut meal the average daily gain per pig was 1.11 lbs., and if $\frac{1}{2}$ corn and $\frac{1}{2}$ palm-nut meal was substituted for corn meal the average daily gain per pig was 1.13 lbs. The mixed rations of corn and palm-nut meal produced the same gains as barley. This was in accordance with the results of earlier tests comparing barley and corn and barley and palm-nut meal.

Slaughter tests were made which, in the author's opinion, indicate that palm-nut meal can entirely overcome the tendency of corn to produce soft pork, both when $\frac{1}{3}$ of the ration is palm-nut meal the whole time and when $\frac{1}{2}$ the ration is palm-nut meal after the animals have reached a live weight of 120 lbs.

A study of all the tests conducted with swine at this station in which corn was fed would, in the author's opinion, seem to confirm the theory that corn produces the softest pork in cold weather. Earlier tests with sunflower-seed cake, which has also been found to produce a soft pork, lead to a similar conclusion. The temperature in the hog house, therefore, seems to be an important factor in the production of first class pork.

The food consumed per pound of gain in these and previous experiments was studied in considerable detail. More food was required per pound of gain as the pigs increased in size. The amount of food required per pound of gain in different seasons of the year was also studied. Pigs of medium weight required 4 lbs. of food per pound of gain in summer and 4.3 lbs. in winter. When they were heavier the corresponding amounts were 4.7 and 5.1 lbs.

The report contains a study of the yield and chemical composition of the different root crops used in the experiments reported above. The following table shows the average composition of some of the foods used.

Composition of feeding stuffs for pigs.

	Water.	Protein.	Ether extract.	Nitrogen free extract, excluding sugar.	Sugar.	Crude fiber	Ash.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Molasses feed	21.05	7.68	1.79	21.53	27.60	13.36	6.99
Swine molasses feed	20.18	6.25	.57	19.69	33.37	11.98	7.98
Blood molasses feed	16.99	16.27	1.56	31.35	16.69	9.72	7.42
Mangel wurzels, Eckendorf	88.56	.48	2.41		6.31	1.09	1.15
Mangel wurzels, Barres	86.81	.48	2.53		8.00	1.08	1.10
Ruta baga Bangholm	87.74	67	3.47		5.55	1.66	.91
Turnips, Bulloch	89.26	.72	2.93		4.16	1.80	1.13
Turnips, Yellow Tankard	90.83	.54	2.52		3.74	1.37	1.00

—F. W. WOLL.

Pig-feeding experiments, N. J. R. DUNSTAN (*Agr. Dept. Univ. Col., Nottingham,* [*and*] *Midland Dairy Inst., Kingston, pp. 9*).—Two feeding tests with pigs conducted at the Midland Dairy Institute farm, Kingston, Notts, are reported. The first test was made with 3 lots of 6 pigs each. The pigs were from 3 litters and so divided that each lot contained 2 pigs from each litter. The tests were made to compare separator skim milk and whey when fed with maize meal, and to determine whether it was more profitable to feed whey and separator skim milk or to sell it for the usual price, which, for the whey, was about 0.67 ct. per gallon and for the skim milk 2.02 cts. per gallon. The daily ration per head fed to lot 1 at the beginning of the test was 5¼ lbs. of maize meal and water *ad libitum.* The pigs in lot 2 were fed 3½ lbs. maize meal and a gallon of separator skim milk daily, with water *ad libitum*, and the pigs in lot 3, 4 lbs. maize meal and 2 gal. whey, with water *ad libitum.* The maize meal was scalded and allowed to soak for a few hours before feeding. When fed it was mixed with the whey and milk. After 20 days the quantity of maize meal fed was increased 1 lb. The test covered 60 days. The maize meal fed was valued at $22.71 per ton. The results of the test are summarized in the following table:

Results of pig-feeding experiments.

	Weight at beginning	Increase in live weight	Relation of dead to live weight	Profit per lot	Cost of food per pound of gain
	Pounds	*Pounds*	*Per cent.*		*Cents.*
Lot 1	843	413	78.3	$18.61	6.30
Lot 2	810	184	76.8	22.24	5.73
Lot 3	854	526	78.4	28.81	5.90

At the close of the test the pigs were slaughtered and judged by an expert. The principal conclusions drawn from the test were as follows: "As to feeding value the maize and whey ration stood first, maize and skim milk second, the maize alone being very far behind." A gallon of separator skim milk and a little less than 2 gal. of whey have the same value as food for pigs. It was much more profitable to feed skim milk and whey than to sell them at the prices prevailing at the time of the experiment. Further, it would be profitable to purchase skim milk and whey at the prevailing prices to supplement maize.

The second test was made with 2 lots of 4 pigs each. The pigs were all from the same litter. The object was to compare barley meal and maize meal when fed with equal quantities of whey. At the beginning of the test the pigs in lot 1 were fed 20 lbs. of barley meal and 8 gal. whey per head daily; those in lot 2, 20 lbs. maize meal and the same amount of whey. After 20 days the grain ration was increased 1 lb. The test covered 63 days. The financial statement is based on barley meal at $26.28, maize meal at $22.71 per ton, and whey at 0.67 ct. per gallon. The total weight of lot 1 at the beginning of the test was 737 lbs.; of lot 2, 731 lbs. The total gain for the two lots was 332 and 402 lbs., and the ratio of dressed weight to live weight 78.6 per cent and 80.9 per cent, respectively. The cost of food per pound of gain of lot 1 was 6.97 cts., and for lot 2, 4.85 cts. The total profit for lot 1 was $13.18, and for lot 2, $24.82. At the close of the test the pigs were sold, slaughtered, and judged by an expert.

> "The barley-fed pigs were leaner in flesh and set better than those fed on maize. The flesh of the maize-fed pigs was fatter than those fed on barley, but set nicely and was of good quality and very suitable for the pork trade. . . . The barley-fed pigs would have been better for the 'curing trade,' but it is very doubtful whether such an increase in price could have been obtained to compensate for the extra cost of producing the better quality pig. . . .
>
> "It will be seen that in fattening pigs some 6 months, old maize meal is a more profitable food for the production of pork than barley meal (when feeding stuffs cost about the prices quoted), and that maize meal produces greater weights of increase than barley meal. Although the pigs fed on barley meal produced the firmer and better quality pork, yet, as long as the butcher makes no difference in price for the two differently fed pigs, it will be noticed that more weight of pork can be produced by the use of maize meal and that at a cheaper rate than employing barley meal in the same quantities."

Investigations on the metabolism of the horse at rest and performing muscular work, N. ZUNTZ, O. HAGEMANN, ET AL. (*Landw. Jah. b.*, *27* (*1898*), *No. 3*, *pp. 440*, *pls. 7*, *fig. 1*).—In this publication the authors report in detail their experiments with horses, some of which have been reported in previous publications.[1]

Experiments are reported in which the balance of income and outgo of nitrogen and carbon was determined, as well as a large number in which the respiratory quotient was determined. The respiratory quotient has been found to vary under different conditions, and furnishes a delicate means of judging of the changes which take place within the body, or the effects produced, for instance, by internal and external muscular work. In some of the experiments the horses performed no work; in others work of various sorts on a level or on an incline was performed. Especial attention was given to determination of the amount of work required for respiration, for the beating of the heart, as well as the energy expended in chewing and digesting food of different sorts.

---

[1] A number of the investigations and the methods followed were noted in Bulletin 45 of this Office, p. 411. For earlier work see E. S. R., 5, p. 822; 8, p. 156. A paper by Professor Zuntz, based in part on this experimental work, appeared as a leading article in the Record (7, p. 538).

Hay and maize as food for horses were compared. Some of the deductions were the following: Maize increases metabolism, markedly stimulating respiration and perspiration. When hay only is fed and work is performed, profuse sweating is induced, the temperature rises, and there is a trembling of the muscles. The effect is less marked when maize only is fed.

Some of the authors' general conclusions are of especial interest. It appears from the investigation that 38.3 per cent of the energy of the food is converted into mechanical work by the horse. On account of the energy required by the beating of the heart and for respiration, which factors increase with muscular work, only about 34 per cent is, however, available for external muscular work.

The authors believe that 3,201 gm. of nutrients is sufficient for a horse weighing 500 kg. and performing no work, when the food contains 1,382 gm. of crude fiber. Further, it is believed that a horse performing no work and weighing 500 kg. requires in twenty-four hours 1,100 gm. of nutrients in addition to that expended for the labor of digestion, this factor requiring not less than 2,100 gm. of nutrients. In these calculations the total nutrients equal the sum of fat multiplied by 2.4, protein, and carbohydrates. The authors found that different foods require different amounts of energy for the labor of chewing and digesting them. On the basis of their investigations, the real nutritive value of a number of common feeding stuffs was calculated. The results are shown in the following table:

Calculated nutritive value of one kilogram of different feeding stuffs.

Feeding stuffs.	Dry matter.	Crude fiber.	Total digestible nutrients.[a]	Labor expended in chewing and digestion.		True nutritive value.	
				In terms of energy.	In terms of nutrients.[a]	In terms of energy.	In terms of nutrients.[a]
	Per cent.	*Grams.*	*Grams.*	*Calories.*	*Grams.*	*Calories.*	*Grams.*
Medium hay (average quality)	85	260	391	828	209	721	182
Alfalfa hay cut at beginning of bloom	84	266	453	866	219	928	234
Red clover hay	84	302	407	944	239	667	168
Winter wheat straw	86	420	181	1,177	297	460	—116
Oats (medium quality)	87	103	615	492	124	1,943	491
Maize	87	17	785	325	82	2,784	703
Field beans	86	69	720	439	111	2,412	609
Peas	86	59	687	402	102	2,319	586
Air-dry disembittered lupines	86	157	645	646	163	1,908	482
Linseed cake	88	94	690	495	125	2,239	565
Potatoes	25	10	226	107	27	787	199
Carrots	15	16	113	82	21	365	92

[a] Protein, plus carbohydrates, plus crude fiber, plus fat multiplied by 2.4.

As will be seen, the nutritive value of straw is negative in the above table. The authors call attention to the investigations which showed that so long as heat alone is considered, the digestible nutrients in straw should be given their full value as shown by the heat of combustion. Provided the labor of digesting a mixed ration does not exceed 2,100 gm. (or 8,316 calories) the digestible nutrients in straw have a positive value. Provided the labor of digestion is greater than this an excess of straw would only increase the internal muscular work so that approximately 116 gm. of nutrients per kilogram is of no value for the body.

From the table the amount of any food or combination of foods required for maintenance may be calculated, according to the authors, as follows: When a horse weighing 500 kg. is fed hay alone, 8.2 kg. would be necessary since, as previously stated, 3,200 gm. of nutrients are required for maintenance. As shown by the table, a kilogram of hay contains 391 gm. total nutrients.

If the ration consists of 3 kg. of hay and 1 kg. of straw and it is desired to make up the balance with potatoes, the amount necessary may be calculated as follows:

	Grams.
Three kilograms of hay furnish total nutrients amounting to....	1,173
One kilogram of straw furnishes total nutrients amounting to...	181
Total..	1,354

Since the horse requires for maintenance 3,200 gm. nutrients, there remain 1,846 gm. total nutrients to be supplied by potatoes. This, divided by 226, the total nutrients in a kilogram of potatoes, gives 8.2 kg. as the amount which must be added to the ration.

The authors note that defects in external conformation and movements necessitate an increased amount of muscular exertion. This has an important bearing upon the purchase of horses. Too low a stall temperature also increases the amount of material required for maintenance. In many cases observed by the authors, this increase was hardly covered by a kilogram of oats daily. Some of the conclusions drawn have to do with the best form of mechanical appliances for utilizing external muscular work. The authors discuss the experiments of other investigators in detail and compare the results with their own.

Economic feeding of working horses, T. H. WALTON (*Agr. Gaz., New South Wales, 9 (1898), No. 2, pp. 169-172*).—Experiments are reported on the successful feeding of molasses to over 400 horses at the Rarawai Sugar Plantation in the Fiji Islands. As high as 30 lbs. of molasses was fed per head daily at different times, but the ration finally adopted consisted of 15 lbs. of molasses, 3 lbs. of bran, and 4 lbs. of maize. In addition green cane tops were fed. The health of the horses was excellent. Molasses did not cause diarrhea, but rather constipation, which was counteracted by feeding bran.

Feeding molasses effected a saving of over $45 per head per annum.

Such a saving, however, in the author's opinion, was possible only by reason of large quantities of waste molasses and valueless cane tops available on the spot.

The composition of Fiji cane molasses and green cane tops is recorded, and was as follows:

Composition of Fiji cane molasses and green cane tops.

	Water.	Protein.		Fat.		Carbohydrates.		Crude fiber.		Ash.
		Digestible.	Indigestible.	Digestible.	Indigestible.	Digestible	Indigestible.	Digestible.	Indigestible.	
	Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
Molasses	26.0	2.5	0.0	0.0	0.0	61.5	0.0	0.0	0.0	10.0
Green cane tops	75.2	1.1	0.6	0.3	0.3	9.5	4.1	4.4	3.0	1.5

The conclusions drawn from the investigation are as follows:

> "For working horses the sugar in cane molasses is a satisfactory substitute for starchy food, being readily digested and transformed into work. Fifteen pounds of the molasses can be given to a 1,270 lb. working horse with advantage to the health of the animal and to the efficiency of its work. It produces no undue fattening, softness, nor injury to the wind. The high proportion of salts in it has no injurious effect. An albuminoid ratio as low as 1 : 11.8 has proved highly suitable for heavy continuous work when a sufficient quantity of digestible matter is given."

Special report on the market for American horses in foreign countries (*pp. 94, pls. 6*).—This report, made by the Secretary of Agriculture to the President, December 12, 1898, is designed to stimulate the export trade in American horses. It contains special articles on Great Britain's purchases of cavalry horses in Argentina, American horses in Belgium, requirements for German army horses, a statement of experience and observation in shipping horses to Germany, horses in France, summary of a communication regarding American horses used by the large horse companies in Paris, France; American horse trade of Great Britain, horse trade with Great Britain, American horses in Denmark, the demand for and kind of horses suited for European uses and the present status of the horse trade in different countries, export of horses from the Chicago market, and a report regarding the export of horses from Buffalo, New York, and vicinity. The bulletin also contains a résumé of the individual reports.

European nations, with the exception of Russia and Hungary, do not produce as many horses as they need. The deficiency is largely made up from exports from Canada and the United States. The American export trade in horses has developed very largely within the last 5 years. In 1893 the total number of horses exported from the United States was 2,967, valued at $718,607; in 1897, 30,532 horses were exported, valued at $4,769,265. Of this number "about 4,000 were exported to Belgium, 1,000 to France, Germany, and Holland, and 20,000 to Great Britain." Ninety per cent of all horses exported to Great Britain were draft horses, 7 per cent high-class coachers, and

3 per cent trotting and light carriage horses. Of the total number shipped to Germany 95 per cent are draft horses weighing 1,500 lbs. or upwards, the remaining 5 per cent being made up of high-class carriage, running, and trotting horses. Most of the latter are reshipped to Austria. Eighty-five per cent of the horses shipped to France are what are termed "cabbers;" the other 15 per cent are about equally divided between draft horses and trotters. About 2 per cent of the shipments to Belgium are trotting or light buggy horses, 23 per cent street-car horses weighing 1,200 lbs., and 75 per cent draft horses, weighing 1,600 lbs. and upward. Many horses are required in Europe for cavalry and other army purposes, as well as for various uses in civil life. The requirements for these different purposes are discussed in considerable detail.

The cost of shipping horses is discussed at some length.

> "It costs from $30 to $40, after the horse is purchased in Chicago, Buffalo, or elsewhere in the eastern half of the United States, before he can be disposed of in London, Antwerp, Paris, or Hamburg. This charge is as great on a cheap as on a high-priced horse; hence, even if there were a demand for them, the profit on cheap horses would be too small to justify the risks. Therefore the horses shipped abroad, while of the same breed and used for the same purpose as those sold for domestic trade, are on the whole a better lot of individuals. . . . It takes some time for the imported horse to recover from the effects of the sea voyage, and doubtless prices would be higher if that time were allowed to elapse before the horses were put up for sale. There would, however, be some expense attached to it, the buyers considering an addition of £2 (about $10) to the price of the horse a fair estimate of the expense required to get him in condition for work."

The economy of using animal food in poultry feeding, W. P. WHEELER (*New York State Sta. Bul. 119, pp. 229–218*).—Tests are reported with chickens, pullets, cockerels, and young ducks to compare rations in which the protein was derived from animal and from vegetable sources. The animal food used was dried animal meal.

The first test with chickens was begun with two lots of 42 each and covered 20½ weeks. At the beginning of the test the chickens were a few days old. A record was kept of any chickens which escaped from the pen in which they were confined, as well as those which died during the test. Lot 1 was fed a ration of animal meal together with some skim milk, wheat, cracked corn, oat meal, and mixed grain consisting of 12 parts of corn meal, 4 parts of wheat flour, 2 parts of ground oats, and 1 part each of wheat bran, wheat middlings, pea meal, and old-process linseed meal. Lot 2 was fed wheat, cracked corn, oat meal, and mixed grain consisting of 6 parts of pea meal, 4 of old-process linseed meal, and 2 each of wheat bran, ground oats, and high-grade gluten meal, and 1 part each of wheat middlings and corn meal. Toward the close of the test a mixture of 2 parts each of old-process linseed meal, wheat bran, ground oats, gluten meal, and 1 part each of wheat middlings and corn meal was substituted for the above. The chickens were also given some skim milk to add to the palatability of the ration. Each lot was fed green alfalfa.

The financial statement is based on corn meal, wheat bran, and wheat middlings at $13 per ton, ground oats at $16, linseed meal at $20, coarse flour at $26, gluten meal at $23, pea meal at $13.50, animal meal and dried blood at $40, and green fodder at $2 per ton. Wheat was rated at 80 and corn at 38 cts. per bushel, and fresh bone at 80 cts. per 100 lbs.

In the first 12 weeks of the first test the chickens fed animal meal gained 50 per cent more than those fed the grain ration. They consumed more food, but required less dry matter per pound of gain. The cost of a pound of gain in the lot fed animal meal was 4½ cts.; in the lot fed grain, 5½ cts. During the first 8 weeks of the test the cost of a pound of gain was 7½ and 11⅕ cts., respectively. The chickens fed animal meal reached 2 lbs. in weight more than 5 weeks before the others, and reached 3 lbs. in weight more than 8 weeks before the chickens fed the grain ration. Three pullets in the lot fed meat meal began to lay 4 weeks earlier than any in the lot fed grain.

The second test was begun with two lots (Nos. 3 and 4) of 33 chickens each and continued for 14 weeks. The chickens were 6 weeks old at the beginning of the test. A preliminary test of 3 weeks' duration, made with 12 chickens, preceded the test proper. The rations were similar to those mentioned above. Lot 3 was given the ration containing the animal meal.

In the second test differences in the two lots similar to those in the first test were noted, although they were not so striking. The principal conclusions of the second test are shown in the following table:

Comparative gains of chickens on animal and vegetable food.

	Dry matter required per pound of grain.	Cost of food per pound of gain	Time required to gain first pound.	Time required to gain second pound.
	Pounds.	*Cents.*	*Days.*	*Days.*
Lot 3 (meat meal)	4.6	5.6	47	30
Lot 4 (grain)	5.2	7.1	61	38

"As with the first two lots, more food was eaten under the ration containing the most animal food. The nutritive ratio of this ration was somewhat the wider, although the amount of protein supplied per fowl was about the same under both rations."

A test covering 56 days is reported with two lots of 19 cockerels about 3 months old at the beginning of the trial. The rations fed and the experimental conditions were practically the same as in the tests with chickens.

"The two lots were alike at the start and averaged almost exactly the same in weight. As in the other feeding trials, the amount of protein supplied per fowl was about the same for the two lots, but the nutritive ratio was somewhat wider with the animal meal ration.

"The gain in weight was not very regular nor very great for either lot, although for short periods some rapid gains were made. Those birds having the animal meal ration gained in weight during the trial about 20 per cent more than the others.

"During the first 8 weeks the consumption of food by the lot fed animal meal (lot 1) was about 28 per cent greater than that of the lot fed grain (lot 2) and the gain in weight was about 40 per cent greater. One pound gain in weight was made by lot 1 for every 8 lbs. of water-free food consumed, and 1 lb. gain by lot 2 for every 8.8 lbs. of water-free food. During the last 4 weeks more food was still eaten by lot 1 but the gain made was considerably in favor of lot 2 as well as the cost of gain. The gain in weight for this period, however, was not economically made by either lot."

A test under conditions similar to those noted above is also reported with two lots made up of 32 and 33 ducklings respectively. Lot 1 was fed the animal meal and lot 2 grain. The test began as soon as the ducklings had learned to eat and was continued until growth became very slow. In this and other experiments data are reported in full in tabular form.

"During the first 10 weeks 2¼ times as much food was eaten by lot 1 as by lot 2 and the total increase in live weight was about four times as great. One pound gain was made by lot 1 for every 3.1 lbs. of water-free food consumed and 1 lb. gain by lot 2 for every 5.2 lbs. of water-free food. The cost of food for each pound gain was about 3.7 cts. for lot 1 and 7.2 cents for lot 2, a difference not far from 95 per ct. in favor of lot 1. The use of the animal meal increased the cost of the one ration, for while it constituted less than one-fifth of the total food beside the alfalfa it represented considerably over one-third of the total cost of the ration. . . .

"The slow growth made by lot 2 for so long a time (during 15 weeks) did not prevent a more rapid gain being made when the ration was more favorable. This is shown by the results of feeding lot 2 for 4 weeks on the animal-meal ration after the contrasted feeding was finished. The growth made by this lot was then rapid and the gain in weight nearly as great as that which had been made by lot 1 2 months earlier when the average size was about the same as that of the older birds from lot 1 during this later period. The disadvantage of living on the inferior ration was, however, never entirely overcome, and the birds failed to reach the size ultimately attained by the birds having from the start the animal-meal ration.

The average weight of 1 lb. was reached by lot 1 3 weeks sooner than by lot 2, the average weight of 2 lbs. over 5 weeks sooner, and the average weight of 3 lbs. over 8 weeks sooner. At 7 weeks of age the average weight for lot 1 was over 3 lbs. and for lot 2 less than 1 lb. At 9 weeks of age the average weight for lot 1 was about 4.5 lbs. and for lot 2 about 1.5. At 11 weeks of age the average weight for lot 1 was 5 lbs. and for lot 2 it was 2 lbs."

Fattening and marketing of poultry, A. H. CATHCART (*Jour. Roy. Agr. Soc. England, 3. ser., 10 (1899), pt. 1, pp. 156–171*).—This article treats of the poultry industry in the East Riding of Yorkshire; poultry fattening at Birdsall, Yorks; the sale of fowls by weight, and the by-products from chickens. Feeding experiments at Birdsall are briefly reported. In one test 32 chickens in 3 weeks consumed 188 lbs. of meal, 7¾ lbs. of fat, and 7¼ gal. of skim milk. At the beginning of the test the chickens weighed from 3 lbs. 3 ozs. to 4 lbs. when fasting and gained from 10 ozs. to 1 lb. 9½ ozs. In the author's opinion, to obtain a fine quality of poultry it is necessary to confine the fowls in cages for 3 weeks. If, however, it is desired to produce flesh at a minimum cost, it is considered more economical to confine the birds only a fortnight.

The author believes that proper attention to the by-products from chickens would materially increase the profits in fattening poultry. It is suggested that chickens' feet be used for the manufacture of jelly and the necks for soup making; that the livers be sold separately; that the feathers from cocks' necks be utilized for tying artificial flies for fishermen, and that the feathers be utilized in other ways. The gizzards are regarded as nutritious and a salable product. It is further suggested that the offal be used for fattening pigs. The value of the droppings as manure is also spoken of.

History and present status of instruction in cooking in the public schools of New York City, Louise E. Hogan (*U. S. Dept. Agr., Office of Experiment Stations Bul. 56, pp. 70, pls. 12*).—The teaching of cooking as a branch of manual training has been introduced into many primary and grammar grade public schools. This bulletin, which contains an introduction by A. C. True, gives the history of the development of this movement in the public schools of New York City, together with a somewhat detailed account of the course of instruction and exercises, including compositions and drawings, prepared by pupils as part of their class-room work.

Examination of the principal sorts of flour used for bread making, G. Fascetti (*Staz. Sper. Agr. Ital., 31 (1898), No. 4, pp. 367–376*).—The author reports the determination of water, total nitrogen, cellulose, ash, and gluten in samples of Italian flour of different grades.

Flour and bread from a botanical standpoint, T. F. Hanausek (*Wiener Illus. Gart. Ztg., 24 (1889), No. 4, pp. 109–119*).—The author describes the seeds, etc., which may be found as impurities in flour and bread.

Chemical composition and nutritive value of Norwegian cereals, F. H. Werenskiold (*Norsk Landmandsblad, 17 (1898), No. 52, pp. 577, 578*).

Banana flour, A. Petermann (*Bul. Assoc. Belge Chim., 13 (1899), No. 3, pp. 147, 148*).—Banana flour is briefly described, and an analysis made by Grégoire is recorded. The percentage of composition was as follows: Water, 5.60; protein, 3.13; fat, 1.73; nitrogen-free extract, 82.39; crude fiber, 1.22; and ash, 5.93. The nitrogen-free extract contained 7.19 per cent of glucose, 3.34 per cent of dextrin, and 45.76 per cent of starch.

Physiological chemistry for medical and other students, F. Bottazzi (*Chimica Fisiologica per uso dei Medici a degli Studenti. Milan (1898), vol. 1, pp. XV + 428; vol. 2, pp. XII + 465; rev. in Nature, 59 (1899), No. 1532, p. 267*).

Muscular work, Destree (*Quar. Jour. Inebriety, 1899, Jan.; abs. in British Med. Jour., 1899, No. 1999, Epit., p. 64*).—Experiments were made on the effect of alcohol, caffein (in the form of tea and coffee), and kola on the production of muscular work. The work was measured with a Mosso ergograph.

Sugar in the nutrition of man and animals (*Rev. Sci. [Paris], 4. ser., 11 (1899), No. 13, pp. 409, 410*).—L. Grandeau's work for the Société d'Agriculture is briefly reviewed.

Hay of Norwegian fodder plants, F. Werenskiold (*Tidsskr. Norske Landbr., 6 (1899), Nos. 1, pp. 35–43; 2, 82–86*).—Includes analyses of mountain hay (*säterhö*), meadow hay, and marsh hay (*myrhö*).—F. W. Woll.

Analyses and feeding value of whale-flesh meal, fish guano, and fish meal, F. H. Werenskiold (*Norsk Landmandsblad, 17 (1898), No. 51, pp. 568–570*).

Mechanical equivalent of materials constituting the ration of draft horses, P. Vuillier (*Bul. Syn. Pyrénées Orientales, 1898, June 16; abs. in Mes. Agr., 4. ser., 10 (1899), No. 8, pp. 118, 119*).—The composition and digestibility of different feeding stuffs are discussed, as well as their value as sources of energy.

The use of sodium dioxid in studying the respiratory function, Desgrez and Balthazard (*Compt. Rend. Acad. Sci. Paris, 128 (1899), No. 6, pp. 361–363*).—Experiments are briefly reported with animals confined in air-tight chambers on the possibility of supplying oxygen by the decomposition of sodium dioxid by water. The alkali formed from the sodium dioxid absorbed the carbon dioxid eliminated in the respiratory products. The experiments were successful.

Farm animals, L. J. TRONCET and E. TAINTURIER (*Le bétail. Paris: Librairie Larousse* [*n. d.*], *2. ed., p. 188, figs. 100*).—This is a popular volume on the horse, mule, sheep, and other farm animals, with a special section on accidents and diseases.

Molasses as a food for animals, E. WERY (*L'Engrais, 14* (*1899*), *No. 17, pp. 400–402*).—A general summary, quoted from *La Sucrerie Belge,* of some of the recent work on this subject.

Experiments on the feeding value of sugar beets, G. SORESI (*Staz. Sper. Agr. Ital., 31* (*1898*), *No. 6, pp. 602-619*).—The yield, size, and composition of a number of sorts of sugar beets are recorded, and rations are suggested which are made up in part of beets.

Ground bone as a food for young cattle (*L'Engrais, 14* (*1899*), *No. 13, p. 304*).—A brief account of experiments by A. Gouin and A. Andouard reported to the Société Nationale d'Agriculture de France on the successful feeding of ground bone to calves.

Maize, rye, barley, and oats as food for horses, G. DE MARNEFFE (*L'Ing. Agr. Gembloux, 9* (*1898*), *No. 5, pp. 239–247*).—A test made with two lots of 15 horses each is reported on the comparative value of oats and barley. Lot 1 was fed 9 kg. of oats per head daily, and lot 2 was fed 5 kg. of oats and 4 kg. of ground barley. The test covered 8 months. The average weight of the horses in lot 1 at the beginning of the test was 473 kg., and of those in lot 2, 469 kg. During the test the average gain per head of lot 1 was 6 kg., and of lot 2, 29 kg. No bad effects due to barley were noticed. The value of maize for horses is discussed at some length, and the experience of a Brussels cab company on the successful use of maize as part of a ration is quoted.

Investigations on continuous crossing, R. SENEQUIER (*Ann. Agron., 24* (*1898*), *No. 11, pp. 497–510, figs. 13*).—Experiments begun in 1889 are reported on the continuous crossing of Larzac and Barbarine sheep.

The farmyard, L. J. TRONCET and E. TAINTURIER (*La basse-cour. Paris: Librairie Larousse* [*n. d.*], *pp. 160, figs. 80*).—Chickens, turkeys, pigeons, ducks, geese, etc., are described and discussed in a popular way. The volume also contains chapters on feeding, hygiene, accidents, and diseases.

Breeding and rearing ducks, J. J. MCQUE (*Agr. Gaz. New South Wales, 9* (*1898*), *No. 2, pp. 199–202, pl. 1*).—The author discusses the subject largely from the standpoint of his personal experience.

The American standard of perfection as adopted by the American Poultry Association, containing a complete description of all the recognized varieties of fowls, J. H. DRENENSTEDT, editor (*Amer. Poultry Association, 1898, pp. 251.*)

Will poultry thrive on grain alone? F. H. HALL and W. P. WHEELER (*New York State Sta. Bul. 149, popular ed., pp. 7*).—This is a popular summary of Bulletin 149 of the station (see p.76).

Bulletin of the United States Fish Commission (*Vol. 17, pp. 426, pls. 22, figs. 18*).—This volume contains a number of special articles on fish and fisheries, as well as the proceedings of the National Fishery Congress held at Tampa, Florida, January, 1898, and the papers read before the congress.

The utilization of waste products and waste places. II, The Clam, G. W. FIELD (*Rhode Island Sta. Bul. 51, pp. 65–70, fig. 1*).—The author believes that clams could be profitably cultivated on many mud flats. The best methods of extending and fostering this industry are discussed.

DAIRY FARMING—DAIRYING.

The period of gestation in cows, H. H. WING (*New York Cornell Sta. Bul. 162, pp. 325–334*).—Observations were made on the period of gestation of a single herd of cows and its descendants during a period of about 10 years. The herd contained an average of about 20 cows, about two-thirds Holsteins and one-third Jerseys, with high grades of these breeds, a few natives, and mixed and crossbred cattle. The observations are reported in detail and summarized as follows:

> "Of 182 births the average period of gestation was almost exactly 280 days. The shortest period was 264 days, the longest 296 days. Approximately equal numbers of births occurred on each day from the 274th to the 287th, inclusive.
>
> "The period of gestation was the same for male and female calves.
>
> "The period of gestation where twins were born was 5 days less than the general average and 8 days less than the average of the single births of the same cows.
>
> "Many cows show a well-marked individual characteristic as to period of gestation, which may be several days longer or shorter than the average."

Feeding experiments with brewery residue for milch cows, E. RAMM and E. MÖLLER (*Milch Ztg., 28 (1899), No. 7, pp. 97–99*).—This material (Brauschlempe) is said to be a new product prepared by a process which utilizes all of the residues obtained in manufacturing beer, including the yeast and the sediment from the cooling of the wort. It is in the form of brown horny pieces similar to macaroni, and for use in the experiments was ground to a meal. It had the following composition: Water, 10.25; protein, 47.2; fat, 0.9, and ash 6.90 per cent.

The feeding experiment was made with 8 cows, 6 kg. of the residue being compared with 6 kg. of peanut meal in alternating periods. The results are given in detail and summarized. The live weight and the yield of milk were very nearly the same on the two feeding stuffs, the average being slightly higher with the brewery residue. The percentage of fat in the case of every cow was slightly lower on the brewery residue than on the peanut meal, the average difference being about 0.26 per cent, so that the daily average per cow was 33 gm. less fat and 45 gm. less of total solids on the brewery residue. Considering the very rich character of peanut meal, the showing for the brewery residue is thought to be very satisfactory.

Butter made while the cows were on the brewery residue was found to be normal in composition, and to be free from any peculiar taste or other characteristic.

It is calculated that with peanut meal at 8 marks ($1.92) per 100 lbs. the brewery residue would be worth 7 marks and 66 pfennigs ($1.88).

The turnipy taste of milk, N. RITLAND (*Milch Ztg., 28 (1899), No. 6, p. 88; Nord. Mejeri Tidn., 14 (1899), No. 2, p. 17*).—A brief account of a Norwegian experiment. Two cows which were on pasturage were fed turnips out of doors and milked in the stable, and later they were fed hay and turnips in the stable and milked out of doors, the object being to test the absorption of the turnipy odor. No grain was fed at any time. The amount of turnips fed was as high as 1 hectoliter (2.84 bu.) per cow daily. Tests of the milk at different times by a number of persons failed to reveal any turnipy taste in the milk. The conclusion is reached that the characteristic taste often observed when turnips are fed is due entirely to the absorption by the milk of the volatile ingredients of the turnips.

A study of the milk supply of Chicago, JANE ADDAMS and H. S. GRINDLEY (*Illinois Sta. Circ. 13, pp. 18*).—A study was made of the cost and composition of milk as furnished to consumers in two districts of Chicago. Determinations of the fat and total solids in 185 samples of milk collected in the winter of 1896–97 in the neighborhood of Hull House and Lewis Institute, and of the fat, total solids, and casein in 100 samples collected in the spring of 1898 in the Hull House district are tabulated. The analyses are considered in connection with a discussion of variation in the composition of normal milk, milk standards, and adulteration, cost, and nutritive value of milk, and the results of the study summarized:

"Of the 272 samples of milk which have been examined and which were sold as whole milk, the variation in total solids ranges from 6.24 to 18.44, a difference of 12.20 per cent. The variation in fat ranges from 0.5 to 10.40, a difference of 9.90 per cent. The solids-not-fat vary from 4.2 to 10.6, a difference of 6.4 per cent. The average percentage of fat in 272 milks is 3.17. In 263 samples the average percentage of total solids is 11.71 and the average percentage of solids-not-fat is 8.54.

"Of the 272 samples, 134, or 49.26 per cent, contain less than 3 per cent of fat, and 181, or 66.54 per cent, contain less than 12 per cent of total solids. Of the 272 samples sold as whole milk only 90, or 33.09 per cent, may be considered as legal according to the city ordinances, and 235, or 86.40 per cent, are below the average of the American analyses of whole milk. In other words, two-thirds of the milk sold was adulterated or below the low requirements of the city."

Butter and butter adulterants, C. B. COCHRAN (*Jour. Franklin Inst., 147 (1899), No. 2, pp. 85–97, pl. 2*).—In distinguishing butter from oleomargarine the author relies quite largely upon the refractive index, amount of volatile fatty acids, and the Valenta test (temperature at which the fat becomes turbid when treated with an equal volume of strong acetic acid). "I have never as yet met a single case in which any one of these tests did not sharply distinguish between butter and oleomargarine." Other tests, as iodin number, saponification number, color tests, etc., are used in doubtful cases. A table is given showing the limits of variation in results usually obtained by these tests for butter, lard, and cotton-seed oil. The author found the Valenta test of much assistance in detecting small amounts of lard in butter.

"A series of tests made at the same time on different samples of fresh butter of known purity will give very uniform results. Stale butters give low results; adulterated butters usually give high results. On account of the liability of the acetic acid to lose strength by absorption of water whenever testing samples of butter of unknown origin, comparative tests should be conducted on fresh samples of known purity. If this precaution is taken I believe the results furnished by the Valenta test will prove to be very important."

A table shows the results of the Reichert test, the Valenta test, and the reading of the Zeiss butyro-refractometer for 8 samples of pure butter obtained from different sources, and for the same after the addition of 10 per cent of lard.

"In every case but one the additions of 10 per cent of lard has raised the results of the Valenta test decidedly above those obtained from pure butter, and this single exception is satisfactorily explained by the fact that this sample was old and very rancid when the test was made. . . . A difference equally marked will be shown in the Valenta test if the butter is adulterated with oleomargarine, oleo oil, tallow, or other animal fats foreign to butter."

A study was made of the crystallization of fats from solution in various liquids. It is believed that if the conditions are kept uniform the crystallization from amyl alcohol will have a uniform characteristic appearance.

The use of cotton-seed oil as a butter adulterant under the name of "cream ripener" is noted, and an experiment is reported in which butter was made from natural cream and cream to which some of the "cream ripener" was added. There was an increased yield with the cream ripener, which is attributed "partly to the difficulty of removing buttermilk, the butter obtained in this case being unusually hard to work." The results of various tests of this butter are reported, and the conclusion is reached that "5 per cent of this oil will give reactions so strong that its presence can not be due to the feeding of cotton seed or to the introduction of cotton-seed oil as a solvent for the coloring matter used in coloring the butter." A number of samples of butter suspected of containing cream ripener were examined and found to give very marked color reactions.

The detection of renovated, or process, butter is described, considerable weight being laid upon the microscopic examination by polarized light, although this is not considered conclusive. The results of examination of 3 samples of renovated butter are given.

"In renovated butters the turbidity temperature, as shown by the Valenta test, is lower than that usually found in fresh butter, and in the Jean modification of the Valenta test a greater amount of acetic acid is dissolved by fresh butter fat. Renovated butters also usually contain a high percentage of free fatty acids."

Commercial butter cultures, H. HAYWARD and M. E. MCDONNELL (*Pennsylvania Sta. Bul. 41, pp. 19*).—Experiments were conducted to determine the effects of Hansen's Lactic Acid Ferment, B 41, the Boston Butter Culture, and a skim-milk starter prepared at the station, upon the flavor of butter made from pasteurized and unpasteurized cream. Incidentally the flavor of butter made from pasteurized and unpasteurized cream under certain varying conditions was compared.

The data are given for six trials made with each culture in cream pasteurized by heating at 150° F. for 20 minutes, and for five trials with each culture in unpasteurized cream. No direct comparison between lots of the same cream pasteurized and unpasteurized and ripened with the same cultures were made.

The butter from each lot was scored for flavor by three judges soon after making, but was not scored again, so that the effect on the keeping quality was not determined.

A table shows the number of bacteria per cubic centimeter in the control lots in each case, the number destroyed by pasteurizing, the number per cubic centimeter that were added in the starters, and the percentage of purity of each culture after it was added to the cream. In the unpasteurized lots it was observed that "it apparently made no difference in the flavor of the butter whether the percentage of the culture bacteria added was 4 or 80 per cent of the total number present." The results are discussed at considerable length, and are summarized as follows:

> "(1) In the light of these experiments, butter cultures may be divided into two classes, the acid-forming and the nonacid forming.
>
> "(2) In pasteurized cream, the nonacid-forming cultures gave results slightly inferior to those obtained with the unpasteurized control lots, ripened spontaneously.
>
> "(3) In unpasteurized cream, the nonacid-forming cultures gave results slightly if any better than those obtained with the control lots, ripened spontaneously.
>
> "(4) In pasteurized cream the acid-forming cultures gave results slightly better than those obtained with the unpasteurized control lots, ripened spontaneously.
>
> "(5) In unpasteurized cream the acid-forming cultures gave results but slightly if at all better than those obtained with the control lots, ripened spontaneously.
>
> "(6) The use of an acid-forming culture seemed to result in greater uniformity in flavor, in butter made from pasteurized cream.
>
> "(7) Of the acid-forming cultures, the skim-milk starter gave results practically as good as did the more expensive commercial cultures, although it was not so conveniently prepared.
>
> "(8) As good, if not better, flavored butter was made from unpasteurized cream ripened with a skim-milk starter as from pasteurized cream ripened with a commercial starter.
>
> "(9) The amount of acid developed in the cream had a very important bearing upon the flavor of the butter. As a rule, the best flavored butter was made from cream in which the development of acid had exceeded 0.55 per cent.
>
> "(10) Close attention to details, cleanliness, and the careful selection of milk at the weigh room promise more in improving the flavor of our butter than pasteurizing and the use of pure cultures."

Heated milk for butter making, H. HAYWARD and F. F. PEPPER (*Pennsylvania Sta. Bul. 15, pp. 5*).—Ten trials were made, to test the comparative values in butter making of separating milk at temperatures of 86° and 155 to 158° F. The milk was heated to these temperatures by means of a Larkey heater. The cream from both lots received the same treatment. A skim-milk starter was used. The data for the experiment, including the scoring of the butter for flavor by three judges, are tabulated. While no advantage in butter making was found to result from heating the milk to 155 to 158° before separating, a considerable disadvantage was found in handling skim milk so treated on account of its souring quickly unless cooled at once, which is not thought practicable.

Report of Danish permanent butter exhibitions for 1898, F. Friis (*Copenhagen, 1899, pp. 42*).—During 1898, 713 creameries participated in these exhibitions, 2,110 tubs of butter being judged in all. The average percentage of water in the butter was 13.93 per cent, the determinations ranging from 10 to 20.05 per cent; 42 tubs, or 2 per cent of the total number, contained more than 16 per cent of water. All but 5 of the creameries exhibiting practiced pasteurization, and all but 11 used commercial lactic starters.

Churning experiments with cream pasteurized at 80, 85, and 90° C.—In most cases Danish butter is manufactured from cream pasteurized at about 75° C. (167° F.); during late years, however, the tendency has been toward pasteurization at higher temperatures. The experiments here reported were made for the purpose of ascertaining the influence of pasteurization at high temperatures on the quality of the butter, especially as regards its keeping quality. The experiments were conducted at 4 different creameries, 43 single trials being made. The cream was pasteurized at the ordinary temperature (75° C.) and at 80, 85, and 90° (176, 185, and 194° F., respectively), and cooled to about 12° C. (54° F.). The butter was scored first the day after it was made, and again 14 days later. The first scoring of the butter from cream pasteurized at 75° C. was taken as *n* in each trial, and the butter from cream pasteurized at higher temperatures was compared with it, the result being indicated by *n* + where the latter was superior. Similarly, in the second scoring all the butter was compared with the *n* of the first scoring. In stating the keeping quality, *d* was taken as the decrease in score between the two scorings of the 75° pasteurized product. The total score in the Danish system of scoring is 15. The average results are shown in the following table:

Summary of results of pasteurization trials in butter making.

Cream pasteurized at—	Number of trials	First scoring		Second scoring		Keeping quality.	
		75° C.	Higher temperature	75° C.	Higher temperature.	75° C.	Higher temperature.
80° C. (176° F.)	3	*n*	*n* + 0.3	*n* − 3.8	*n* − 2.1	*d*	*d* + 1.4
85° C. (185° F.)	21	*n*	*n* + .4	*n* − 2.8	*n* − 1.5	*d*	*d* + .9
90° C. (194° F.)	19	*n*	*n* + .2	*n* − 2.0	*n* − 1.3	*d*	*d* + .5
Average		*n*	*n* + .3	*n* — 2.9	*n* — 1.6	*d*	*d* + .9

Both the flavor and the keeping quality of the butter from cream pasteurized at higher temperatures were better than in case of butter from cream pasteurized at 75° C. The keeping quality of the former was superior in 29 out of 43 cases, the same as that of the lower pasteurized product in 9 cases, and inferior in this respect in 8 cases. The "cooked taste" which appears in butter from cream pasteurized at high temperatures, according to the author, will disappear in the course of a short time. The cooling of the cream practiced in these experiments was not considered sufficient, but could not be carried further under existing conditions in the creameries where the work was done. Rapid and rigid cooling is essential in high-temperature pasteurization.

The chemical analyses which were made fail to show any appreciable difference in the fat content of the buttermilk or the water content of the butter from pasteurization at the different temperatures.—F. W. WOLL.

Some observations on the formation and improvement of dairy cattle, H. L. O. WINBERG (*K. Landt. Akad. Handl. Tidskr., 37 (1898), No. 5-6, pp. 296-308*).

Type more important than breed, C. L. BEACH (*Hoard's Dairyman, 30 (1899), No. 6, pp. 112, 113, figs. 8*).—The record is given for different types of cows in the herd of the Storrs Agricultural College, with illustrations of cows and remarks on the feeding and net profit.

"In comparing breeds with types, we find the range in amount of butter produced to be, with the Jerseys 371, Ayrshires 266, or a difference of 105 between the highest and lowest. The variation due to type is 273 lbs.

"In a similar way, the range in the cost of 1 lb. of butter between the breeds is 4 cts., while the range between the types is 8½ cts.

"The range in net profit between breeds is $16.25, while the range between types is $41.07.

"We may conclude, then, that the form or type, more than breed, will determine the ability of a cow to produce butter economically."

Brief manual of dairying and stock raising, A. A. KALANTER (*St. Petersburg, 1898, pp. II + 252, figs. 120; rev. in Selsk. Khoz. i Lyesov., 191 (1898), Oct., p. 229*).—The book gives among other things information about the existing schools of dairying, traveling dairies, etc.

Questions of dairying in the Caucasus (*Tiflis: Imperial Agricultural Society of the Caucasus, 1897, pp. II+32+77+204+22; rev. in Selsk. Khoz. i Lyesov., 192 (1899), Jan., pp. 229, 230*).

Feeding experiment with fermented skim-milk feed, L. F. NILSON (*K. Landt. Akad. Handl. Tidskr., 37 (1898), No. 5-6, pp. 309-342*).—Detailed report of the feeding experiments with 30 cows, of which an abstract has already been given (E. S. R., 10, p. 487).—F. W. WOLL.

Feeding experiments with Tropon residue for milch cows, E. RAMM and E. MÖLLER (*Milch Ztg., 28 (1899), No. 2, pp. 17-19*).—This material is obtained as a by-product in the manufacture of the new protein preparation Tropon, which is made from a mixture of animal and vegetable material. The by-product is said to resemble pea bran in appearance and to contain 89.22 per cent of dry matter, 22.01 of protein, and 9.07 of fat. It was fed in an experiment with 8 cows in comparison with an equal amount of peanut meal. The results of the short trial show that although it contained considerably less digestible protein, the Tropon residue "completely replaced the peanut meal," and the conclusion is reached that it is of equal value to peanut meal.

The college herd (*Michigan Sta. Rpt. 1897, pp. 86, 87*).—This contains a condensed record of the individual cows of the herd, reference to the application of the tuberculin test to the herd and the purchase of a new herd, and some deductions from the herd record, previously given in greater detail (E. S. R., 9, p. 1081)

Influence of feed on quantity and quality of milk, C. F. CURTISS (*Northwest. Cream. Jour., 1 (1899), No. 9, pp. 12-14*).

Influence of spaying on milk production, FLOCARD (*Abs. in Dairy, 11 (1899), No. 124, p. 123*).—Between 1879 and 1888 the author performed the operation on 1,950 cows, with a loss of only 9; and from 1888 to 1897 he operated on 2,505 cows, without a single accident. He notes the increase in yield of milk and richness of spayed cows, and that "a spayed cow fattens more readily, its flesh is better, is heavy, rosy, and streaked with fat, and its juice is abundant and rich."

Refrigeration in dairying, F. Seret (*L'Ing. Agr. Gembloux, 9 (1899), No. 8, pp. 485–487, fig. 1*).

Contribution to the question of detecting butter adulteration, T. Pfeiffer (*Chem. Ztg., 23 (1899), No. 5, pp. 39, 40*).—The author reports the case of butter known to be pure which was considerably below the limit of volatile fatty acids. He is unable to account for this occurrence, as the cows were well nourished, but suggests that it may have been due to the clover and grass fed.

Testing milk for nitrates, E. Ackermann (*Schweiz. Wchnschr. Chem. u. Pharm., 1898, p. 285; abs. in Ztschr. Angew. Mikros., 4 (1899), No. 10, pp. 269, 270*).

How shall we drink our milk, sterilized, pasteurized, or raw? C. W. Sorensen (*Dairy, 11 (1899), No. 124, pp. 102, 103*).—After treating popularly of the methods and results of sterilizing and pasteurizing, and of the prevention of infection by proper handling of milk, the author concludes as follows:

"In plain language, pasteurization is but a cure for dirt and disease, and the public has a right to something more than this. It has a right to the prevention of this dirt and disease. Sterilization is essentially objectionable, and pasteurization, to be efficient, costs money. It is true that the preventive measures I would have adopted also cost money. But I state emphatically, from actual experience, that such prevention is not only better but cheaper than any such cure. Let the public awake to its right to pure milk, raw yet undefiled, and dairymen will find it in the long run to their own truest interest to cater in an enlightened spirit for this legitimate and natural demand."

An artificial milk, C. Meyer (*Berlin. Klin. Wchnschr., 1898, No. 19; abs. in Hyg. Rundschau, 9 (1899), No. 6, p. 308*).—Instead of using milk as a basis, as is the case with most artificial preparations, the constituents of milk (albuminoids, milk sugar, butter fat, salt, and water) are mixed in definite proportion. The mixture has the appearance and taste of natural milk and an alkaline reaction. The casein is prepared from cows' milk and curdles with acid in a finely divided condition; it is completely digested by pancreas in from 2 to 3 hours. Experiment showed that the fat was resorbed to a satisfactory degree and the loss of nitrogen was not greater than under ordinary conditions. The artificial milk is intended for infants and invalids.

Churn to prevent over churning (*Dairy, 11 (1899), No. 121, p. 126, figs. 3*).—A description of an invention patented in Germany by F. Lengowski and F. Komnick.

Pure cultures vs. home-made starters, J. R. Campbell (*Dairy, 11 (1899), No. 124, p. 107*).—A lecture on the author's experiments in using pure cultures in cheese making. His conclusion is that a pure culture is needed for the production of a proper curd, and that it is immaterial how this is procured. He calls attention to some precautions to be observed in using home-made starters.

On the handling, application, and manufacture of pure-culture starters, L. F. Rosengren (*Mejeri Praktiken, 1898, No. 23; Nord. Mejeri Tidn., 13 (1898), No. 48, pp. 691–693*).

Swedish butter exhibitions during 1898 (*Tidskr. Landtmän, 19 (1898), No. 50, pp. 895–903*).—During the year 335 creameries took part in the exhibitions, 1,303 tubs having been exhibited, scored, and analyzed. The average water content was 13.5 per cent, the range being from 10 to 22.9 per cent; 2.3 per cent of the tubs contained over 16 per cent of water.—F. W. WOLL.

Denmark's butter export, 1897-98, B. Bøggild (*Tidsskr. Landökon, 17 (1898), No. 7–8, pp. 472–481*).—The export from October 1, 1897, to September 30, 1898, amounted to 143,058,018 Danish pounds, and the export over and above imports to 108,954,370 lbs., an increase of over 16,500,000 lbs. over that of 1896–97. Denmark sent 139,500,000 lbs. of butter to England during 1897-98.—F. W. WOLL.

VETERINARY SCIENCE AND PRACTICE.

Investigations on sheep pox, L. DUCLERT (*Ann. École Nat. Agr., Montpellier, 10 (1897–98), pp. 103–170*).—The disease known as sheep pox is restricted entirely to sheep, only one observer having produced the disease in goats. All other animals have a complete natural immunity from the disease. The author believes that cowpox and the smallpox of man are perhaps caused by the same or very similar germs, but that sheep pox is of a different nature. The micro-organism which causes the disease has not been determined. Certain corpuscles supposed to be the cause of the disease were found by Guarnieri, but this supposed discovery was later discredited. The author records a large number of experiments in which he produced the active virus in the subcutaneous tissue of sheep and reproduced the disease by injecting this virus into sheep. It was found that the virus could be attenuated by subjecting it to a temperature of 25° C. Immunity from the disease was produced by injection of this attenuated virus.

Abortion in cows, T. W. CAVE (*Agr. Dept. Univ. Col., Nottingham, [and] Midland Dairy Inst., Kingston, pp. 8*).—The author discusses accidental and contagious or epizootic abortion, quoting at some length the experiments and conclusions of Bang, and reports the treatment of contagious abortion in the Midland Dairy Institute herd. Twenty-four cows were given 1 dram of pure carbolic acid twice a week. It was dissolved in a quart of hot water, diluted with 2 gal. cold water, and sprinkled over the food. No bad effects were noticed. After a month the dose of carbolic acid was increased to three times a week, and during the third month of the test it was reduced to two times per week. The cows were then pastured and the carbolic acid was discontinued until the following winter, when it was again given twice a week. In addition to this treatment the sheds were disinfected and the cows were treated with disinfectants and the stables also disinfected. Whenever a cow aborted she was removed to a separate shed, the afterbirth burned as soon as discovered, and the surroundings thoroughly disinfected. No aborting cow was allowed service again. The treatment began in February, 1897. Cases of abortion occurred till the end of the following June and then ceased. Up to October, 1898, no cases of abortion had occurred among the cows treated. As a control on the value of the treatment, 6 heifers at pasture received no treatment. Every one of these aborted.

The cure and prevention of rinderpest, G. TURNER and W. KOLLE (*Dept. Agr. Cape Good Hope, Report on the Cure and Prevention of Rinderpest, 1898, pp. 87*).—Experiments were tried in protecting cattle by means of the simultaneous injection of virulent blood on one side of the animal and a dose of serum on the other. The number of animals experimented with was 9,007, and the deaths resulting from these inoculations numbered 128. The number of animals which did not show evident signs of rinderpest under this treatment did not exceed 10 per cent. It was found necessary to mix serum from 90 to 100 animals in order to secure a constant strength. Large doses of serum were found to confer immunity for several months. If the animal was already infected with the disease, a larger dose of serum was required.

Immunity was produced also by injecting virulent blood and following it one or two days later by an injection of serum, or the serum may be injected first and the virulent blood at varying intervals afterwards.

Tuberculin experiments at Hamra, Sweden, O. STENSTRÖM (*Tidskr. Landtmän, 10 (1899), Nos. 1, pp. 8–11; 3, pp. 43–46*).—Three new tuberculin preparations were tested with reference to their value in diagnosing tuberculosis in cattle. All were prepared from sterilized pure cultures of tubercle bacilli. No. 1 was dissolved in water, No. 2 in 4 per cent glycerin, and No. 3 in a 5 per cent carbolic acid solution. Fifteen animals which had been found tuberculous in previous tests with common tuberculin were injected with 5 cc. of these tuberculin preparations, each preparation being tried on 5 animals. All preparations proved good diagnostic agents for bovine tuberculosis. No. 2 was perhaps the strongest of the three, producing in every case a rise in temperature of 2 to 3° C. This preparation also gave a decided reaction in cases of cows that had been rendered immune by previous injection with large quantities of common tuberculin. The injections in these trials were made about 5 months after the first injections. When the 5 animals that had reacted with preparation No. 2 were injected again a week later only 1 of the cows reacted, showing that by repeated injections this tuberculin may fail to give a reaction in case of tuberculous cows.

In studying the question of the time interval in which tuberculin will fail to give a reaction with tuberculous animals, 30 tuberculous cows were separated into 3 groups of 10 each. One group received 1 gm. of tuberculin per head every other day except the first 3 times when ½ gm. was used, the second group received ½ gm. each once per week, and the third group received ½ gm. each once a month, and later twice a month.

The experiment was discontinued December 19, 1897, when the animals in the different groups had received the following quantities of tuberculin per head: Group 1, 128.5 gm. in 130 injections; group 2, 20.5 gm. in 41 injections; group 3, 8 gm. in 16 injections. Group 1 failed to give a reaction after the fifth examination, while in the case of the animals in the other two groups no reaction was obtained after the first examinations. In the author's experiments, common tuberculin was not found to possess any therapeutic properties.—F. W. WOLL.

The serum treatment of swine plague and hog cholera, E. A. DE SCHWEINITZ (*U. S. Dept. Agr., Bureau of Animal Industry Bul. 23, pp. 18*).—Several years ago the author isolated 2 albuminoid substances and several amins which would produce immunity against hog cholera and swine plague when injected into hogs. In experiments which were tried with these substances about 50 per cent of the treated animals lived. This was not considered entirely satisfactory, and later the author isolated certain enzyms or soluble ferments. These were much more effective in producing immunity, and serum from animals which had been rendered immune by these enzyms could in turn be used for immunizing other animals. It was found that hogs could be immunized by long continued injection of the ordinary intestinal bacillus (*B. coli communis*). With serum from one animal other animals may be rendered immune, but in order that the antitoxic substances may be continually found in the blood serum it is necessary to give the animal continued injections of the cell contents or products of the germ.

Extended field experiments were tried in Page County, Iowa. The serum for the work was prepared from cattle, horses, mules, and donkeys, but, as the author remarks, "experiments had shown that the serum prepared for the purpose of curing hog cholera was useful in protecting or curing small experimental animals from hog cholera only, and that serum prepared for the purposes of curing swine plague was useful in protecting from swine plague only." In consequence of this fact the author prepared a mixed serum for curing hog cholera and swine plague. This was especially advisable since it is difficult to distinguish in the field between hog cholera and swine plague.

The quantity of the serum used for pigs weighing from 40 to 60 lbs. was 10 cc. Out of 196 animals treated with the mixed serum, 161 were saved, or about 82 per cent. In the herds which were not treated only 15 per cent recovered. In 1898 further work was done along the same lines. Thirty five herds, containing 1,727 animals, were treated; 403 died, which was a loss of 23.16 per cent. The number of animals in check herds was 3,197; only 600 of these survived, or 81.24 per cent was lost.

The Bureau of Animal Industry is enabled to produce this serum at a cost of about 15 cts. per dose, but only in limited quantities for the present. In order to prevent the carrying of the contagion from one herd of swine to another, careful disinfection of the premises is recommended, as well as of the farmer's boots, clothing, wagons, etc.

On the importance of the lymphatic system for the modern doctrine of infection and immunity, L. MANFREDI (*Arch. Path. Anat. u. Physiol.* [*Virchow*], *155* (*1899*), *No. 2, pp. 335–378*).—Records a number of experiments with toxins and concludes that the lymphatic glands have the power of attenuating the virus of infectious diseases.

Influence of the lymphatic glands in the production of immunity against infectious diseases, L. MANFREDI and P. VIOLA (*Ztschr. Hyg. u. Infectionskrank.*, *30* (*1899*), *No. 1, pp. 64–94*).—The lymphatic glands possess a natural resisting power against the virus of most infectious diseases, and they help materially to bring about immunity against these diseases.

Contributions to the question of the specific action of immunizing serum, C. MANN (*Arch. Hyg.*, *34* (*1899*), *No. 3, pp. 179–191*).—Concludes that agglutination and immobilization of bacteria does not prevent their growth.

The importation and exportation of live stock, D. Bernier (*Rev. Facult. Agron. y Vet. La Plata, 1898, No. 2, pp. 52-75*).—Contains various and detailed suggestions on quarantine laws. Recommends the thorough inspection of export and import animals and the use of tuberculin and mallein.

The histological alterations in cases of poison by ricin, G. Cruz (*Arch. Med. Exper. et Anat. Path., Paris, 1. ser., 11 (1899), No. 2, pp. 238-258, pls. 2*).—Guinea pigs were the subjects experimented upon. Ricin was given by means of hypodermic injections. Autopsies were made a few hours after death, and detailed descriptions are given of the microscopic effects upon all tissues.

On the rôle of leucocytes in poisoning by a soluble arsenical compound, Besredka (*Ann. Inst. Pasteur, 13 (1899), No. 3, pp. 209-224*).—An increase in the number of leucocytes after injection of the poison indicates a resistance on the part of the organism to the poison and a probable recovery. A decrease in the leucocytes indicates the opposite condition. Arsenious acid was the poison used and the experiments were on rabbits and guinea pigs.

Some interesting cases observed in the inspection of meat in Stockholm, G. Kjerrulf and S. Nystedt (*Svensk Vet. Tidskr., 4 (1899), No. 3, pp. 109-112*).—Records the finding of measles (*Cysticercus tarandi*) in the meat of reindeer, and a *Helminthiasis nodularis* in the intestines and peritoneum of cattle which was produced by the young of *Œsophagostoma inflatum.*

A preliminary note upon certain organisms isolated from cancer and their pathogenic effects upon animals, H. G. Plimmer (*Proc. Roy. Soc. [London], 64 (1899), No. 411, pp. 431-436*).—The author experimentally produced malignant tumors in rabbits and guinea pigs by an organism isolated from cancer in man.

Clinical study of vertigo, G. Chenier (*Rev. Vet. Toulouse, 24 (1899), No. 5, pp. 277-285*).—Reports clinical observations on this disease in horses and in man.

Investigations on the ciliated infusoria which occur in the stomach of ruminant animals, A. Guenther (*Ztschr. Wiss. Zool., 65 (1899), No. 4, pp. 529-572, pls. 2*).—Various species of infusoria are carried into the stomach of sheep, cattle, and goats on hay and in water. The hay can be sterilized with boiling water. The physiological effect of the presence in the stomach of great numbers of these infusoria is not yet determined.

Is the presence of smut spores on fodder injurious? G. Staes (*Tydschr. Plantenziekten, 4 (1898), No. 4, pp. 116-128*).—Compiled information is given from various sources, from which it is concluded that smuts are not injurious to animals as a rule.

The stock owners' indebtedness to the microscope, C. J. Pound (*Queensland Agr. Jour., 4 (1899), No. 3, pp. 202-216*).—Gives a general account of the progress of our knowledge on the diseases anthrax, tetanus, actinomycosis, and tuberculosis.

The pathological-anatomical changes in the organs of animals after infection with the bacillus of the black plague of man, F. V. Karaulof (*Sci. Mem. Kazan Vet. Inst., 16 (1899), No. 2, pp. 92-108*).—The author calls attention to the striking similarity between the bubonic plague of man and the rinderpest of cattle. Experimental tests were made in inoculating rats, mice, pigs, cattle, dogs, cats, horses, and birds with the bacillus of the black death of man. The materials for the inoculation were the following: The black death bacillus in pure cultures, small pieces of various organs of subjects which died of the black plague, and dust collected from houses in which the black plague had existed.

The cattle plague and bubonic plague with investigations of Dr. Koch, Critzman (*Ann. Hyg. [Paris], 41 (1899), Jan., pp. 29-39*).—Records experiments in immunizing cattle and two species of monkeys. The antipest serum is shown to have curative as well as immunizing value. The immunity lasts from 3 to 5 months.

Serum treatment for rinderpest, D. Hutcheon (*Veterinarian, 72 (1899), No. 856, pp. 260-269*).—Records a series of experiments in combating rinderpest during which defibrinated sterilized salted blood from immunized animals and regularly prepared serum were used.

Cattle tuberculosis, T. M. LEGGE and H. SESSIONS (*London, 1898, pp. 78*).

The hereditary transmission of tuberculosis, E. N. Y BALBUENA (*Vet. Españ., Madrid, 42 (1899), No. 1486, pp. 33-37*).—The writer believes he has evidence of hereditary transmission of tuberculosis, and maintains that all diseases which are characterized by morphological and dynamic changes of any part of the organism may be inherited.

Tubercular disease in dairy herds, G. S. THOMPSON (*Jour. Agr. and Ind., South Australia, 2 (1899), No. 7, pp. 560-563*).—Gives a general history of our knowledge of tuberculosis and advises thorough testing of all dairy cattle with tuberculin.

Researches on the histogenesis of the tubercle and the curative action of tuberculin, A. BRODEN (*Arch. Med. Exper. et Anat. Path., Paris, 1. ser., 11 (1899), No. 1, pp. 1-53, pls. 4*).—Tuberculin increases the natural power of resistance of the organism in its struggle against the bacillus and is not to be considered a new specific force which is not present in the organism.

Tuberculosis, J. W. BRITTLEBANK (*Agr. Students' Gaz., n. ser., 9 (1898), No. 3, pp. 69-74*).—Gives general recommendations concerning the use of tuberculin.

New contributions on the subject of the value of tuberculin as a diagnostic agent for tuberculosis, D. VAN DER SLUIJS (*Tijdschr. Veeartsenijk. en Veeteelt, 26 (1898), No. 1, pp. 19-26*).—Gives clinical records of a large number of tuberculin tests.

Results of the application of the tuberculin test to Her Majesty's dairy cows at Windsor, J. MCFADYEAN (*Jour. Comp. Path. and Therap., 12 (1899), pt. 1, pp. 50-56*).—Gives the temperature record of 40 cows under the tuberculin test.

Investigations for determining the value of ordinary tuberculin, W. DÖNITS (*Klin. Jahrb., 7 (1898), No. 2, pp. 225-234*).—By using a large series of guinea pigs it is possible to determine the value of a given tuberculin by the minimal fatal dose and to compare the strength of different tuberculins. The author criticises the ordinary methods of determining the strength of different tuberculins.

Anthrax (*Jour. Bd. Agr. [London], 5, No. 4, pp. 455-458*).—Recommends the thorough destruction of the carcasses of all animals which have died of anthrax.

The influence of lecithin and organic bodies containing lecithin (yolk of egg and brain) on the biology of the splenic fever bacillus, W. TARANUCHIN (*Russk. Arch. Pathol., Klin. Med. i Bact., 6 (1898), No. 1*).

New investigations on malaria, Texas fever, and the tsetse fly disease, G. H. F. NUTTALL (*Hyg. Rundschau, 8 (1898), No. 22, pp. 1084-1103*).

A case of ergotism, M. ROBIN (*Rec. Med. Vet., Paris, 8. ser., 6 (1899), No. 5, pp. 149-151*).—Gangrene of the extremities began to show in this case on the fourteenth day. Treatment was entirely unsuccessful.

Hygiene of domestic animals, H. GEORGE (*Jour. Agr. Prat., 1 (1899), No. 17, pp. 602-605*).—Gives an account of the poisoning of cattle with rape-seed cakes, and multiple gangrene in a cow caused by eating ergotized rye.

Experiments on immunity to foot and mouth disease, SIEGEL (*Deut. Med. Wchnschr., 24 (1898), Nos. 47, pp. 749, 750; 48, pp. 766-768*).

Investigations on the destruction of the contagion of foot and mouth disease in manure, HECKER (*Berlin. Tierärztl. Wchnschr., 1899, Jan. 5, pp. 6, 7*).—Infected manure may be sterilized by covering with noninfected horse manure for 8 days to the depth of one-third to one-half meter.

On typical and so-called contagious abortion, M. STREBEL (*Schweiz. Arch. Tierh., 40 (1898), No. 5, pp. 203-215*).

Laryngeal syngamus of cattle, M. A. RAILLIET (*Compt. Rend. Soc. Biol., Paris, 10. ser., 6 (1899), No. 8, pp. 174-176*).—Describes as new under the name *Syngamus laryngeus*, a syngamus found in the larynx of domestic cattle.

Aphthous fever and methods for preventing the same, F. MERCIER (*La fièvre aphtheuse et les mesures a prendre pour éviter la contagion. Beauvais, 1898, pp. 12*).—

Describes the disease and gives an account of how contagion may be carried with suggestions as to prevention.

Trembling, or peripheral enzootic neuritis of sheep, C. Besnoit (*Rev. Vet. Toulouse, 24* (*1899*), *No. 5, pp. 265–277*).—Gives the history of our knowledge of this disease together with the diagnosis and an account of the symptoms.

The diseases of horses—their pathology, diagnosis, and treatment, H. Dalziel (*London, 1898, pp. 102*).—A dictionary of equine materia medica is added.

On the treatment of Morbus maculosus of horses with Argentum credé, P. Meissner (*Berlin. Tierärztl. Wchnschr., 1899, Mar. 16, pp. 133–135*).—Intravenous injections of 0.5 gm. Argentum credé are recommended for the disease.

Diseases of the pig, O. Hilfreich (*Das Kranke Schwein. Neudamm, 1898, 2. ed., pp. 90, pl. 1, figs. 25*).—The symptoms and treatment of diseases of swine are given, as well as information on judging the flesh of diseased pigs.

Experimental investigations on hog cholera and swine plague, Karlinski (*Ztschr. Hyg. u. Infektionskrank., 28* (*1898*), *No. 3; abs. in Centbl. Bakt. u. Par., 1. Abt., 25* (*1899*), *No. 1, pp. 26–29*).—A number of experiments with pigs and other animals are reported.

On vaccination against swine plague and the cure of this disease by serum, O. Schreiber (*Berlin. Tierärztl. Wchnschr., 1899, Mar. 9, pp. 110*).—The author has used a serum which will cure both swine plague and hog cholera and will also produce immunity to either disease.

Concerning a nonmotile hog-cholera bacillus, Theobald Smith (*Centbl. Bakt. u. Par., 1. Abt., 25* (*1899*), *No. 7, pp. 241–244*).—Gives the appearances and behavior of this bacillus on different culture media.

Combating chicken cholera, P. Willach (*Deut. Tierärztl. Wchnschr., 7* (*1899*), *No. 14, pp. 125–128*).—By thorough disinfection of the premises and by giving of lysol internally, an outbreak of chicken cholera was entirely checked.

AGRICULTURAL ENGINEERING.

Irrigation in Mesilla Valley, New Mexico, F. C. Barker (*Water Supply and Irrig. Papers, U. S. Geol. Survey, No. 10, pp. 51, pls. 11, figs. 5*).—This bulletin discusses the location, history, and climate of this valley and the methods of irrigation and cultivation in common use.

Mesilla Valley lies on both sides of the Rio Grande, and extends from Fort Selden on the north to within 3 miles of El Paso, Texas, on the south—about 55 miles. For the greater part of its length it is from 5 to 7 miles wide. "Along its entire course it is bounded on the east and west by lofty ranges, the highest of which—the Organ Mountains, distant some 12 miles to the east of the valley—rise to a height of 8,000 ft. above sea level, or 4,000 ft. above the agricultural lands along the river."

The main source of water supply is of course the Rio Grande, the characteristics of which are described in some detail. It is liable to become dry after July 1, thus emphasizing the need of storage reservoirs. Several such reservoirs have been projected, but not yet built. The water of the Rio Grande carries a large amount of sediment, which is of high fertilizing value,[1] but renders furrow irrigation very unsatisfactory by silting up the bottoms and sides of the furrows and thus retarding the percolation of the water.

---

[1] New Mexico Sta. Bul. 12 (E. S. R., 5, p. 1002).

The methods of agriculture by irrigation as practiced in this valley are believed to be, by the author, the oldest that exist in the United States, being largely an inheritance from the Mexicans, who learned them from the Spaniards.

> "The irrigating canals or ditches in the Mesilla Valley, of which there are 8, are what are termed 'communal ditches;' that is, they were built and are owned, kept in repair, and regulated by the members of the community who hold lands under them. . . . No scientific method of apportioning the water, either by measurement or by time, has been adopted. . . . When water is abundant, everyone helps himself whenever he needs it; and should it be scarce, as is sometimes the case, the mayordomos arrange to let each farmer have what appears to them a fair share, that share being fixed rather by the needs of the individual than by his share of interest in the ditch."

Flooding in checks is the method most commonly used, the furrow system frequently proving unsatisfactory, for the reasons stated above.

Pumping water for irrigation has been resorted to in but few cases in the valley, "although abundant water can be obtained almost everywhere at depths varying from 14 to 85 ft., this depth depending upon the height of the land above the level of the river bed."

The use of barnyard manure has been found very beneficial—in fact, indispensable, especially for vegetables. The benefit from the manure is ascribed to its physical effect and biological action.

"The methods of irrigation and cultivation in common use by the natives of the valley are discussed with a considerable degree of detail."

Irrigation systems in Texas, W. F. HUTSON (*Water Supply and Irrig. Papers, U. S. Geol. Survey, No. 13, pp. 68, pls. 10, figs. 12*).—This paper is based upon field work carried on during May and June, 1897. It includes an introduction by F. H. Newell; general statements regarding the retardation of development, use of water, distribution of rainfall, and climatic and geographic divisions, and descriptions of irrigation works and projects of the eastern Gulf coast region, central Texas, San Antonio and vicinity, Nueces River and lower Rio Grande, Llano Estacado, Pecos Valley, and Trans-Pecos Texas.

> "The variety of geologic and climatic conditions and the mixed population in Texas have given rise to many methods of practice, so that there may be found representatives of nearly every system of irrigation occurring in the United States. Every degree of excellence may be noted, from that of modern machinery for raising water down to the most primitive devices for supplying it to the field. In the arid and semiarid portions of the State the methods of the early Spanish settlers are employed. Most of the cultivation is done by Mexican laborers or tenants, who cling to the old systems. Thus, on most of the ditches the distribution of the water is by the Spanish method of days and hours, each holder of a water right having the use of the ditch in his turn."

The more important facts relating to irrigation in Texas are summarized in the following table:

Comparison of capacity and cost of various systems of water supply in Texas.

Name.	System.	Pump.	Lift in feet.	Capacity, second-feet.	Acreage.		Cost.		
					Irrigable.	Irrigated.	Total.	Per acre.	Annual per acre.
Catron	50 H. P. engine	Menge	8	11.14		500	$1,500	$3	
Stubenrauch	8-foot windmill		25		15	7	300	43	
Do	12 foot windmill[a]				30		485	16	
Lytle	Dam and ditch				300		25,000		
Lewis	do				50	10	200	20	
Metcalf	do					470		7	$0.75
Glenn	do				350	250	3,500	14	
McGee	do				250	75	1,500	20	
Swinden	80 H. P [b]	Centrifugal		6.84	400				
Baker	32 H. P. engine[d]	Worthington		2.72	80	75	2,000	27	[c]6.00
Willis	Turbine			.11		5			
Aldridge	20 H. P. engine[e]			1.00	75				
Lindsey	30 H. P. engine[f]			1.87		40	2,000	50	
Vanderstucken	18 H. P. engine	Menge		2.60		100	1,500	15	
Richards	Water wheel			.20		3			
Garrett	do			.32		12			
Upper Labor	Ditch				600	100			2.00
Trueheart	Ditch[g]			30.00	1,500	400	18,000	15	2.50
Kampman	Artesian well			2.32	1,000	250	3,000		
Pickett	40 H. P. boiler[h]	Blakeslee	50	1.67	400	100	2,500		[c]4.00
Crandall	10 H. P. boiler[i]	Blake	48	.20			295		
Simmons	2½ H. P. gasoline			.07		10	450		
Experiment	5½ H. P. gasoline		48	.05	20				
Grover	100 H. P. boiler[j]	Menge	48	14.00	500	70	5,000		1.00
Miller	40 H P. boiler	Double	89	.29	140	70	3,000		
Del Rio	Dam and ditches					3,600	25,000		.50
Urbahn	80 H. P. boiler	Pulsometer	65	1.11	125	50			
Sterneberg	Windwill					3	220		
Charleston	12 foot windmill[b]		30			5	425		
Closner	25 H. P engine	Centrifugal		10.58		100			
Rabb	50 H. P. boiler	Menge	18	20.00		200	2,000		
Brulay	100 H. P. boiler	Centrifugal	22	17.82	300	200			
Goodrich	14 foot windmill		10			18	300		
Wayland	3 windmills		50		25		505		
Murray	8 foot windmill[b]		124			1½	222		
Margueretta	Dam and ditch				40,000	6,000	150,000	10	1.50
Pecos R. I. Co.	do				20,000	600	35,000	5	.50
Grand Falls	do							15	1.25
El Paso					30,000	3,000	220,000		2.00

[a] Combined water power and irrigation.
[b] With reservoir.
[c] Approximate.
[d] Operating cost, $7 a day of 12 hours.
[e] Can water 5 acres per day.
[f] Operating cost, $3 per day of 11 hours.
[g] Water rights held at $15.
[h] Costs 12½ cts. per hour to operate.
[i] Pumps into reservoir.
[j] Operating expenses, $4.25 per day.

Water rights of the Missouri River and its tributaries, E. MEAD, J. E. FIELD, and J. M. WILSON (*U. S. Dept. Agr., Office of Experiment Stations Bul. 58, pp. 80, pls. 2, figs. 4*).—This is the first of a series of bulletins to be prepared in accordance with the provisions of the clause in the appropriation act for this Department for the current fiscal year authorizing the collection "from agricultural colleges, agricultural experiment stations, and other sources, including the employment of practical agents, of valuable information and data on the subject of irrigation, and publishing the same in bulletin form." After consultation with experiment station officers and irrigation engineers in the region specially interested in the subject of irrigation, it was decided that the investigations provided for by the above act should, for the present, be confined to two general lines: (1) The collation and publication of information regarding the laws and institutions of the irrigated region in their relation to agriculture, and (2) the publication of available information regarding the use of irrigation waters in agriculture as shown by actual experience of farmers and by experimental investigations, and the encouragement of further investigations in this line by the experiment stations. In accordance with this plan, the first bulletin discusses the laws which control the diversion and use for irrigation of the waters of the Missouri River and its tributaries, explaining the methods by which users establish and enforce their rights to a common supply, and pointing out the legal and physical complications which conflicting or imperfect State laws have created. The vast extent of the irrigated region and the peculiar problems presented by different large areas made it unadvisable to attempt to cover the whole field in a single bulletin. It was deemed preferable for this first bulletin to select a single region covering portions of several States in which there was in general sufficient likeness in the agricultural conditions as affected by irrigation to render it possible to make a clear and definite statement of the problems of water rights and of the directions in which improved legislation is required. The area embraced in the discussion includes Colorado, Kansas, Montana, Nebraska, North Dakota, South Dakota, Wyoming, and the Northwest Territories of Canada. The bulletin discusses principles and explains the methods of procedure which farmers must follow in the different States in making and recording water right filings.

Abstract of laws for acquiring titles to water from the Missouri River and its tributaries, with the legal forms in use, E. MEAD (*U. S. Dept. Agr., Office of Experiment Stations Bul. 60, pp. 77*).—This bulletin, the nature of which is explained in its title, is supplementary to Bulletin No. 58 of this Office (see above), and with it forms a manual of instruction regarding the methods of procedure in acquiring water rights in the Missouri River watershed.

Draft of farm implements, M. W. FULTON (*Michigan Sta. Bul. 165, pp. 97-100*).—The tests here reported were of wagons, subsoilers, harrows, and mowers. The draft was determined by means of a self-recording dynamometer.

Comparative tests were made of broad (4 in.) and narrow (1⅝ in.) tires on different kinds of roads. "The results all favor to a very marked degree the wide tires. While upon a gravel road, hard, smooth, and well packed, the difference in draft is but 6.62 per cent, using a narrow tire as a basis, upon sod or raw ground, the difference is so marked as to be decisive." On sod the draft was 23.35 per cent in favor of wide tires; on corn stubble, 32.83 per cent. These tests were all made with wagons carrying a load of 4,500 lbs. A comparison was made of the draft of a wagon with the load equally distributed on all four wheels and with the load placed over one axle. "The results seem to show that where the road is firm and smooth it is immaterial whether the load is evenly distributed over the 4 wheels or not, but where the ground is soft the draft is increased if the weight is very largely upon the front or the hind wheels." In trials of hitching the horses to the whiffletrees in the ordinary manner and to the end of the tongue, the result showed no marked difference in draft which could be attributed to the difference in point or method of attachment. Removing the grease from the skeins and boxes of the wheels and adding a little grit increased the draft of a wagon 22.34 per cent.

"Late in the fall of 1896 a test was made of the draft of two forms of subsoil plows. In one case the loosening of the subsoil was accomplished by forcing through it a flat tongue-shaped piece of steel. In the other curved teeth stir up the subsoil. Three teeth were used, each approximately an inch in width, and so curved as to dig to a considerable depth below the bottom of the furrow left by the ordinary plow. Subsoiler No. 1 was provided with a wheel which maintained a uniform depth. No. 2 with the curved teeth had no appliance for regulating the depth, and in practice it was found impossible to keep it from gouging in deep in the softer places and running somewhat shallower than desired in others.

"The average draft on 4 trials of each subsoiler at an average depth of 10 in. below the bottom of the furrow left by the ordinary plow was for No. 1 504 lbs. and for No. 2 606 lbs."

In comparative tests of a floating spring-tooth harrow having 15 teeth and a riding spring-tooth harrow with 17 teeth, the following results were obtained on freshly plowed sandy loam, harrowed to a depth of 3 in.: With the driver riding the draft of the wheel harrow was 513 lbs.; with the driver walking the draft was 346 lbs. The draft of the floating harrow, under the same conditions, was 402 lbs. On an unplowed compact loam, harrowing to a depth of 4 in., the average draft of the wheel harrow was 570 lbs. with the driver riding and 513 lbs. with the driver walking. Under the same conditions the average draft of the floating harrow was 608 lbs. The harrows were about 5 ft. 9 in. wide.

In comparative trials of two 5-foot cut mowers on a field of clover and timothy, yielding about 2 tons per acre, the average draft was 244 and 246 lbs.

Notes on irrigation, E. C. CHILCOTT and R. S. ROE (*South Dakota Sta. Bul. 61, pp. 29-31, pl. 1*).—These notes describe the method of irrigation practiced in connection with growing forage and garden crops in the James River Valley in 1898 (E. S. R., 10, p. 629). General directions for irrigating are given.

Trials of farm machinery at Ultuna Agricultural College, H. JUHLIN DANNFELT (*Tidskr. Landtman, 19 (1898), Nos. 47, pp. 837-843; 48, pp. 860-863; 49, pp. 873-879; 51, pp. 920-923; 52, pp. 934-938; 20 (1899), No. 1, pp. 6-8*).—Trials of mowing machines, horse rakes, and potato diggers. No details are given of the trials.—F. W. WOLL.

The steam plow in Finland, C. J. MYRSTEN and J. JERNSTRÖM (*Biet, 19 (1898), No. 11, pp. 255-272*).

Report of trials of refrigerating machines, September, 1898, E. P. BONNESEN (*Tidsskr. Landökon, 1899, No. 2, pp. 49-86*).—Trials with carbonic-acid, ammonia, and sulphurous-acid machines. The first kind proved the most efficient, and the ammonia machine next.—F. W. WOLL.

STATISTICS—MISCELLANEOUS.

Organization lists of the agricultural colleges and experiment stations in the United States, with a list of agricultural experiment stations in foreign countries (*U. S. Dept. Agr., Office of Experiment Stations Bul. 59, pp. 115*).—This bulletin contains the organization list of agricultural colleges and experiment stations in the United States, a subject list of publications of the experiment stations received by the Office during 1898, the Federal legislation relating to the colleges and stations, the rulings of the Post-Office, Treasury, and Agricultural Departments as to the construction of the act of Congress of March 2, 1887, establishing the stations, and a list of agricultural experiment stations and kindred institutions in foreign countries compiled from various sources.

A report on the work and expenditures of the agricultural experiment stations for the year ended June 30, 1898, A. C. TRUE (*U. S. Dept. Agr., Office of Experiment Stations Bul. 61, pp. 113, pls. 14*).—This includes a critical review of the conduct and general management of the stations, with brief abstracts of all station publications received during the fiscal year ending June 30, 1898; and general statistics relative to organization, publications, principal lines of work, revenue, expenditures, etc.

Tenth Annual Report of Michigan Station, 1897 (*Michigan Sta. Rpt. 1897, pp. 79-397*).—This includes a financial statement for the fiscal year ending June 30, 1897, a report by the director, departmental reports, parts of which are noted elsewhere, and reprints of Bulletins 135-144 of the station on the following subjects: Fertilizer analyses (E. S. R., 8, p. 584), fattening lambs (E. S. R., 8, p. 1008), feeding corn smut to dairy cows (E. S. R., 8, p. 1007), pig feeding (E. S. R., 8, p. 1011), bacteria (E. S. R., 9, p. 121), ropiness in milk (E. S. R., 9, p. 183), forage crops and wheat (E. S. R., 9, p. 131), small fruit trials at the college (E. S. R., 9, p. 354), fruit tests at South Haven (E. S. R., 9, p. 353), and vegetables old and new (E. S. R., 9, p. 350).

A second report to Congress on agriculture in Alaska (*U. S. Dept. Agr., Office of Experiment Stations Bul. 62, pp. 51, pls. 11, figs. 2*).—This contains a review by the director of the progress made in investigating the agricultural capabilities of Alaska during 1898, and reports on agricultural investigations (p. 42), botanical survey (p. 28), and climate (p. 31).

Third report of committee on methods of teaching agriculture (*U. S. Dept. Agr., Office of Experiment Stations Circ. 39, pp. 7*).—This report, submitted to the Association of American Agricultural Colleges and Experiment Stations at Washington, D. C., November 15, 1898, gives a syllabus for a course of instruction in agronomy (plant production).

Land-grant and other colleges and the national defense, C. W. DABNEY (*U. S. Dept. Agr., Office of Experiment Stations Circ. 40, pp. 15*).—An address delivered before the Association of American Agricultural Colleges and Experiment Stations at Washington, D. C., November 15, 1898 (E. S. R., 10, p. 706).

Report of the Ministry of Agriculture and Imperial Domains for the fourth year of its existence, ending March 30, 1898 (*St. Petersburg, 1898, pp. 300*).

Report of the agricultural experiment station "Zapolye," Petersburg Government, Loozhski district, 1897, J. J. SOKHOTSKI (*St. Petersburg, 1898, pp. 82*).

Contribution to the study of the natural and scientific principles of agriculture in the forest and steppe region of European Russia, P. BARANOV (*St. Petersburg, 1898, pt. 1, pp. IV+XV+148; rev. in Selsk. Khoz. i Lyesov., 191 (1898), Dec., pp. 713, 714*).

Primitive agriculture in Finland during historic times, G. GROTENFELT (*Det primitive Jordbrukets Metoder i Finland under den historiska Tiden. Helsingfors, 1899, pp. 444, ill.*).

NOTES.

FLORIDA STATION.—The new board of control appointed by the governor on May 18 is constituted as follows: President, E. A. Foster, of Gainesville; vice-president, G. W. Wilson, of Jacksonville; secretary, F. E. Harris, of Ocala; E. D. Biggs, of Pensacola; C. A. Carson, of Kissimmee, and J. D. Calloway and L. Harrison, of Lake City.

MAINE STATION.—Horace L. White has resigned his position as assistant chemist of the station, and E. R. Mansfield has been appointed in his stead.

MARYLAND STATION.—At the recent meeting of the board of trustees, held June 9, provision was made for assistants in chemistry and horticulture. The college farm was united with the station farm, to be run under the direction of the station. It was decided to abandon all investigations in veterinary science, the veterinarian confining his work to the general oversight of the health of the animals on the farm and acting in the capacity of consulting expert. An appropriation was made for continuing the work in connection with irrigation experiments.

MICHIGAN COLLEGE AND STATION.—By a recent action of the board the director of the station is relieved from all teaching in the college except in the special courses in the winter. He is made superintendent of institutes and extension lecturer. Greater emphasis is to be laid on experimental work and there is to be a clearer line of demarcation between the station and college. H. W. Mumford has been advanced to the full professorship of agriculture. L. R. Taft will have an assistant professor of horticulture and will devote a larger part of his time to the experimental work in his department.

MISSOURI COLLEGE AND STATION.—Walter Williams has been appointed a member of the governing board of the station, *vice* G. B. Rollins, retired. The legislature recently enacted a law taxing collateral inheritances 5 per cent for university endowment, which it is believed will in time yield a handsome endowment. Appropriations aggregating $142,700 were also made, including $95,000 for maintenance, $25,000 for laboratories and libraries, $1,200 for student labor, and $10,000 to be added to a private donation from W. L. Parker, of Columbia, for the building of a $25,000 hospital. The legislature also established the chairs of architecture in the agricultural college, anatomy in the medical school, and domestic economy in the agricultural college. The first two chairs will be filled this summer and the last in the autumn of 1900. The faculty of the agricultural college lately decided to offer the degree of Bachelor of Science in agriculture to all students doing one year's work in sciences allied to agriculture in addition to securing the regular degree of Bachelor of Agriculture, heretofore offered. This gives those who desire it a degree of higher standing, entitling students to do work for the Master's degree anywhere in the country. The college is offering this summer a school in agriculture and horticulture for teachers of Missouri, lasting six weeks—from July 15 to August 26—covering the elements of these sciences as they may be taught in the public schools. The State Superintendent of Education of Missouri not only accepts grades made here, but has also placed the study of the elements of agriculture in the list of subjects to be taught in the county institutes for teachers throughout the State.

OKLAHOMA COLLEGE AND STATION.—G. E. Morrow, president, director, and agriculturist; Henry E. Glazier, vice-director and horticulturist, and J. H. Bone, associate agriculturist in the college and station, retired from their work June 30. A. C.

Scott, professor of English and literature in the college, has been elected president, and John Fields, associate chemist of the college and station, has been made director and chemist of the station. G. L. Holter, chemist of the college and station, will devote his time exclusively to the college work.

TENNESSEE STATION.—R. L. Watts, horticulturist of the station, has been made secretary, and A. M. Soule, formerly assistant professor of agriculture in the Agricultural and Mechanical College of Texas, has been appointed agriculturist of the station.

TEXAS COLLEGE AND STATION.—By a recent action of the legislature this college is to have eight members of the board instead of six, the members being elected for terms of 6 years, two retiring at the same time. An appropriation of $31,000 was made for the erection and equipment of an agricultural-horticultural building, to be commenced at once. Among other things, a new dormitory to cost $24,000 and a sewage system costing $5,000 were provided for.

A STATE EXPERIMENT STATION IN UTAH.—The last session of the legislature passed an act creating a State experiment station and appropriating $6,000 to start the work. This station is located in Washington County and is placed under the control of the State board of horticulture. It is supported entirely by State funds and has no connection with the agricultural experiment station at Logan, Utah.

VERMONT STATION.—W. A. Orton, assistant botanist, has severed his connection with the station to accept a position in the Division of Vegetable Physiology and Pathology of this Department.

AGRICULTURAL EXPERIMENT STATIONS IN JAPAN.—A brief account of the organization and work of agricultural experiments in Japan was given in E. S. R., 10, p. 101. A recent communication from S. Kikkawa, director of the San-in Experiment Station, gives some additional information regarding the development of these institutions. There are now in the Empire of Japan 10 experiment stations under Government control, besides 19 branch stations the chief work of which is to teach farmers the application of the results obtained by the higher experiment stations. As rice is the most important crop of the country, the experiments and investigations of the stations are naturally devoted chiefly to that plant. Each station, however, has certain other lines of work peculiar to itself. Thus among the crops to which the San-in Station pays particular attention is one known locally as umakoyashi (*Medicago denticulata*). This plant has been selected for experiment by the San-in Station because its cultivation and utilization as a green manure is a matter of special importance in the district in which the station is located. Analyses made by this station show the plant to contain 0.78 per cent of nitrogen, comparing favorably in this respect with clovers and other leguminous plants.

EXPERIMENT STATION RECORD.

VOL. XI. NO. 2.

Brief mention has been made of the establishment by the British Government of an Imperial Department of Agriculture for the West Indies, with Dr. Daniel Morris, formerly assistant director of the Royal Gardens at Kew, as commissioner. The first number of the *West Indian Bulletin*, the official organ of the new department of agriculture, just received, gives the history of the movement and an account of the department, its purposes, aims, etc. The experimental and educational work which it is instituting, its field of operation, and the problems presented to it, make the new department worthy of more extended notice than our previous information permitted.

It will be remembered that the extreme depression of the sugar industry in the West Indian Colonies, which caused many sugar plantations to be abandoned and threatened others, led the British Government to appoint a West Indian Royal Commission in December, 1896, to investigate the condition of the islands and suggest measures for relief. The report of the Royal Commission pointed out the causes of the "critical" condition, and emphasized the need of improving and cheapening sugar production by the introduction and improvement of varieties of cane, better methods of culture, and the prevention of excessive losses in the manufacture of sugar in some cases by using more efficient machinery. It also strongly recommended the introduction of other farm industries where possible, and the teaching of agriculture in different classes of institutions. The commission commended the work of the botanic stations already established in a number of the islands, and recommended that they be enlarged and extended and placed under a central department of agriculture, which was to be charged with the promotion of the agricultural interests of the colonies in general.

The recommendations of the commission in this and other matters have been adopted and carried into effect. The British Government appropriated £4,500 for the new department for the first year, and it is estimated that in future an annual grant of £17,500 will be required to carry out the recommendations of the commission as adopted. "The cost of the department for a period of ten years will be provided from Imperial funds, and grants will also be made in aid of the public revenues of Trinidad and Tobago (for the benefit of the latter islands), British Guiana, Barbados, the Windward Islands, and the Leeward Islands, to provide for or to assist in the maintenance of agricultural and botanical establishments, industrial schools, or other kindred purposes."

The headquarters of the department are at Barbados. Its duties as outlined are twofold: "(1) To endeavor to restore the sugar industry to a condition in which it can be profitably carried on, and (2) to encourage the establishment of other industries in such colonies as afford suitable conditions to supplement the staple industry."

In inaugurating its experimental work, advantage will be taken of the beginning previously made in experimenting in cane growing and the improvement of cane at a number of places, and this work will be greatly developed and extended. Four "principal" or "central" experiment stations and eight "local" stations for the improvement of the sugar cane will be established on the island of Barbados. The object of the central stations will be the growing of seedlings and improvement of varieties, and the carrying on of fertilizer experiments. The more promising varieties will be given a practical trial at the local stations to test their adaptability and value in different soils and localities, and also as a demonstration to the planters in each parish. Experiments on similar lines have been arranged for at Antigua and St. Kitts, while the work previously inaugurated at Trinidad will be largely extended and the necessary chemical assistance provided.

The botanic stations placed under the control of the department are those at Tobago, Grenada, St. Vincent, Barbados, St. Lucia, Dominica, Montserrat, Antigua, and St. Kitts-Nevis. The expense of their maintenance has been transferred to Imperial funds. The object of these stations is to test and distribute promising economic plants for the region, introduce new or little-known plants for experimental cultivation, and conduct experiments on the improvement of sugar cane. In addition they distribute information, and send out lecturers for institute work.

The excessive losses in sugar manufacture on the smaller islands, under the crude methods employed, is emphasized by the statements that there is "an average of over 2,000 pounds of sugar per acre left in the canes after crushing, which is burnt in the megass;" and that owing to heavy losses in boiling, "for every 100 pounds of crystallizable sugar contained in the juice, not more than an average of 75 pounds of ordinary muscovado sugar is now produced." It is said that at present about 13 tons of cane are required to produce a ton of sugar on these smaller islands, while with efficient machinery 9 tons would suffice. The remedy recommended by the Royal Commission is the establishment of central factories equipped with the best machinery, and it is the expectation of the department to establish one or two experimental factories at an early date.

The new department will also promote agricultural education in the islands, which heretofore has received little attention. The plan of the Royal Commission to establish agricultural schools in connection with the botanic stations has been carried out by opening a school at Dominica, and others will be started at St. Vincent, St. Lucia, and

St. Kitts-Nevis as soon as the necessary land is obtained. Furthermore, "the department is prepared to offer grants to enable certain institutions to employ teachers in agricultural science, and possibly provide a number of scholarships for the most promising pupils;" and in cooperation with the central educational authorities in each colony, the teachers in the elementary schools will be given a course of instruction in the principles of agriculture, to enable them to give simple instruction and conduct school gardens. It is proposed to attach an agricultural instructor to each of the botanic stations, who will travel about holding meetings and demonstrations, and imparting information on improved methods directly to the planters; and in addition instructors or experts in special lines, as budding and pruning fruit trees, curing tobacco, bee keeping, etc., will be employed to spend a month or two on each island.

The publications of the department will also be a means of diffusing popular information. They will include handbooks on the cultivation of special crops, bulletins, and leaflets, the latter especially being in very simple, clear language. The *West Indian Bulletin*, mentioned above, will be issued by the department periodically. The first number of this journal contains an introductory, an account of the establishment of the department, and a report of the first agricultural conference, held at Barbados. The latter contains a number of papers of merit on different features of cane growing, central factories, agricultural education, etc.

It will be seen that a very liberal and comprehensive plan has been adopted for acquiring and diffusing information, and that no effort is to be spared to make the department of the greatest direct benefit to the planters and to bring the teachings of agricultural science home to them. The progress of the new department in its various branches will be a matter of much interest to people of this country, especially in view of our interest in islands adjacent to those for whose benefit it was established. The experience there will prove of value, as well as the actual contributions to agricultural science and practice.

RECENT WORK IN AGRICULTURAL SCIENCE.

CHEMISTRY.

Official methods of analysis of fertilizers and feeding stuffs adopted by the Belgian State laboratories and the agricultural experiment stations of Holland and the Grand Duchy of Luxemburg (*Bul. Min. Agr.* [*Belgium*], *No. 5, pp. 22*).—This is a revision, made at a conference in January, 1899, of the methods already noted (E. S. R., 10, p. 304). The only changes of consequence are (1) the insertion of directions for determining water-soluble phosphoric acid by digestion, (2) a modification of the method for determining citrate-soluble phosphoric acid, and (3) more detailed directions for determining the fineness of slags.

The method for determining water-soluble phosphoric acid is as follows: Triturate 20 gm. of the substance with 20 to 25 cc. of cold distilled water in a glass or porcelain mortar. Pour off the liquid into a liter flask and repeat the operation several times, finally transferring all of the material to the flask. Make the volume to about 900 cc. and shake in a rotary apparatus for ½ hour. In default of a rotary apparatus allow to stand for 2 hours, shaking several times. In case of double superphosphate, continue the digestion for 24 hours, shaking from time to time. Make the volume to 1 liter, filter, and use 50 cc. of the filtrate for determination of phosphoric acid by the molybdate or citro-mechanical method.

The method for the determination of phosphoric acid in the combined water and citrate extracts is modified as follows: Boil the mixture of the water and citrate extracts (50 cc. of each) for 5 minutes with 10 cc. of hydrochloric acid (1.10 sp. gr.) or 15 cc. of nitric acid, nearly neutralize the acid with ammonia, and determine phosphoric acid by the citro-mechanical method, adding 10 cc. of Petermann's citrate solution.

In the revised method for ascertaining the fineness of slag the material is first put through a sieve having round holes 1½ mm. in diameter. The material which does not pass this sieve is discarded as worthless. A portion (50 gm.) of the slag which passes the sieve is shaken for 15 minutes in a second sieve having meshes 0.0289 mm. square for the determination of the fineness. A second portion is used without further preparation for the determination of phosphoric acid, correction being made for the part which does not pass the coarse sieve.

Detection of the adulteration of bone superphosphate, H. Lasne (*Staz. Sper. Agr. Ital., 31* (*1898*), *No. 3, pp. 270–314, pls. 9*).—This article gives detailed directions for microscopical and chemical examinations. It is claimed that, as a rule, the microscopical examination, together with determinations of phosphoric acid, lime, alumina, and manganese, will be sufficient for a decision as to the purity of the material. When additional evidence is desired the fluorin may be determined.

The principal adulterants to be guarded against are stated to be gypsum, mineral phosphates, bone ash, precipitated bone, and mineral phosphates, residue from the manufacture of gelatin and glue, and various nitrogenous substances, such as dried blood, horn, etc.

According to the author, the ratio of the phosphoric acid to the lime in pure bone superphosphate should be from 1:1.3 to 1:1.35. A higher ratio than 1:1.35 indicates the addition of gypsum, natural phosphates, or residues from gelatin or glue manufacture; a lower ratio than 1:1.3, the addition of precipitated phosphate; but this rule should be applied with caution, as a mixture might be used which would fall within the limits given.

In pure bone superphosphate, however, the alumina should never exceed 0.1 per cent. It should contain no manganese, less than 0.1 per cent of calcium fluorid, 0.05 per cent of calcium chlorid, and 0.3 per cent of insoluble residue free from nitrogen.

Scattered particles of carbon indicate the presence of bone ash; the presence of hair and particles of epidermis and calcium chlorid, refuse from glue works, and the presence of 1 per cent of nitrogen (calculated to original substance) in the insoluble residue indicates the addition of nitrogenous matters, such as meat, horn, etc.

The methods proposed for some of the principal determinations are as follows:

Phosphoric acid.—Dissolve the material without previous calcination in hydrochloric acid, and evaporate to dryness to remove silica. Take up in the usual way and make up to a convenient volume. (See E. S. R., 7, p. 853.) To a quantity of the filtered solution corresponding to 0.5 to 1 gm. of the superphosphate, diluted to about 100 cc., add 25 cc. of ammonium citrate, 60 cc. of ammonia (22° B.), and 20 cc. of a solution of magnesium chlorid (25 gm. per liter of water). After shaking 15 minutes, or standing 4 hours, precipitation is complete. The author prefers, however, to allow the solution to stand 12 hours. Proceed as usual. This method is considered preferable to the uranium and molybdic methods.

Water-soluble and citrate-soluble phosphoric acid.—Treat 1.25 gm. of the material 2 or 3 times with water in a glass mortar without grinding, filtering the solution into a 125 cc. flask. Then grind the substance with about 50 cc. of water, allow to stand, and pour the clear solution into the filter. Wash by decantation at least 6 times, using in all about 125 cc. of water. To the filtered extract add a few drops of hydrochloric acid and make the volume up to exactly 125 cc. Place the filter in the vessel containing the residue from the extraction with water, add 50 cc. of ammonium citrate, and allow to digest for 12 hours, shaking occasionally at the beginning of the operation. Filter and make the solution up to 125 cc. Phosphoric acid is determined by the method described above in 100 cc. portions of the solution thus obtained and of the solution obtained by extraction with water, citrate being added only in case of the aqueous extract.

Lime.—To a clear solution of ½ gm. of substance, add ammonia to the point of persistent turbidity. Clear up the solution by adding a few drops of dilute hydrochloric acid; slowly add neutral ammonium oxalate and keep the solution at about 100° C. for 1 or 2 hours. After cooling, collect the calcium oxalate on a filter and weigh first as carbonate and then as oxid of calcium. The precipitate thus obtained contains a trace of phosphate. To remove this, redissolve and precipitate again by the addition of a very small amount of ammonia. Collect the precipitate on a filter, calcine, weigh, and deduct the weight from that first obtained. A trace of calcium remains in the solution from the oxalate precipitate. To recover this, oxidize the solution with nitric acid and bromin water, and precipitate with a very small amount of ammonia. Combine the precipitate thus obtained with the preceding. Dissolve both in nitric acid and precipitate the phosphoric acid with molybdic acid. Add ammonia to the filtrate from this precipitate to remove iron, alumina, and traces of molybdenum, and precipitate lime in the filtrate from the precipitate obtained by ammonia with oxalate in the usual way, adding the weight of lime to that previously obtained. The accuracy of the lime determination is vitiated if any considerable amount of manganese is present. This is removed by dissolving the calcined material in nitric acid and adding potassium chlorate to the boiling concentrated solution.

Alumina.—The method proposed for the determination of alumina has already been noted (E. S. R., 7, p. 915).

Fluorin.—Fluorin is determined by treating the substance with strong sulphuric acid in presence of an excess of silica, the silicon fluorid being collected in caustic soda by means of a current of dry air. To determine the amount of fluorin absorbed by the soda solution, precipitate the silica with carbonate of ammonia, filter, and remove remaining traces of silica by evaporation in presence of an ammoniacal solution of oxid of zinc. Precipitate the solution freed from silica with calcium chlorid in presence of an excess of sodium carbonate, calcine gently the precipitate obtained, treat with an excess of acetic acid, evaporate to dryness, and treat with dilute acetic acid. The calcium fluorid remains undissolved and is weighed.

Chlorin.—Mix 20 gm. of the phosphate with half its weight of pure lime and calcine gently in a crucible, the surface of the material being covered with a thin layer of lime. Dissolve the contents of the crucible in dilute nitric acid in a closed flask, filter the solution, and precipitate the chlorin with silver nitrate.

Nitrogen.—Determine nitrogen by the Kjeldahl method. It is occasionally desirable to determine ammoniacal nitrogen. For this purpose, the author prefers caustic soda in very slight excess for use in distillation, claiming that all of the ammoniacal nitrogen is not obtained by the use of magnesia.

Insoluble residue.—The method of treating the insoluble residue has already been noted (E. S. R., 8, p. 560).

Directions are also briefly given for the determination of sulphuric acid, carbon dioxid, magnesia, iron, zinc, manganese, nickel, and cobalt.

This paper was awarded the prize offered by the Association of Italian Fertilizer Syndicates for the best methods of detecting adulteration of bone superphosphate.

The constitution of the ammonium-magnesium phosphate of analysis, F. A. GOOCH and MARTHA AUSTIN (*Amer. Jour. Sci., 4. ser., 7 (1899), No. 39, pp. 187–198; Ztschr. Anorgan. Chem., 20 (1899), No. 2, pp. 121–136*).—As a preliminary to the main inquiry the authors studied the solvent effect of ammonium chlorid solutions of varying strengths on the ammonium-magnesium phosphate precipitate. It was found that as little as 0.0001 gm. of magnesium oxid was detected by means of microcosmic salt in 500 cc. of faintly ammoniacal water containing as high as 60 gm. of ammonium chlorid. From these results "it is plain that strongly ammoniacal liquids are entirely unnecessary in the precipitation of the ammonium-magnesium phosphate under the conditions."

In the study of the influence of varying amounts (none to 60 gm.) of ammonium chlorid on the precipitation of magnesium in the cold by means of microcosmic salt, 3 methods of procedure were followed. (1) The liquid was made faintly ammoniacal after the addition of the precipitant, and the precipitate was filtered off immediately after complete subsidence; (2) the precipitate first thrown down was redissolved in a very little hydrochloric acid and reprecipitated by dilute ammonia (the operation being repeated several times); and (3) the supernatant liquid was poured off through the filter (which was to be subsequently used to collect the phosphate) after the precipitate had subsided, and the insoluble phosphate was dissolved in hydrochloric acid and precipitated again, after dilution, by the addition of a slight excess of dilute ammonia. The results by the first and second methods always showed a plus error. Theoretical results were obtained by the third method, when no ammonium chlorid was added before reprecipitation. In other experiments the influence of varying amounts of ammonia was studied. In the author's opinion the results seemed to point "to a general tendency on the part of free ammonia, ammonium chlorid, and excess of the phosphate to produce a salt rich in ammonia and deficient in magnesia, which, for a definite amount of magnesia precipitated, must leave upon ignition a residue weighing more than the normal phosphate. If it be assumed that a salt of the symbol $(NH_4)_4Mg(PO_4)_2$ (the next natural step to the normal salt NH_4MgPO_4) is present in the precipitate, the residue which such a salt would leave upon ignition would be the metaphosphate $Mg(PO_3)_2$." It is estimated that the amount of metaphosphate necessary to account for the error in some of the precipitates was as high as 10 per cent.

In investigations on the determination of phosphoric acid in soluble phosphates by means of magnesia mixture, it was found that complete precipitation took place in faintly ammoniacal solutions even when dilute and charged with large amounts of ammonium chlorid, provided the magnesia mixture was used in sufficiently large excess.

In the precipitation of monosodium phosphate by magnesia mixture, following the same methods of procedure used above in the precipitation of the magnesium salt, it was found that while the results were not entirely regular, the tendency was for ammonium salts to produce minus errors, the size of the error varying with the proportion of ammonium salts used, and that an excess of magnesia mixture tended to correct these errors.

> "These facts are quite in harmony with the hypothesis that the ammonium salt tends to produce an ammonium magnesium phosphate richer in ammonia and phosphoric acid and poorer in magnesia than the normal salt NH_4MgPO_4; for, though the production of such a salt in presence of an excess of the soluble phosphate compels the combination of a definite amount of magnesium with more than the normal amounts of phosphoric acid and ammonia (as was the case in the former series of experiments), when the supply of the soluble phosphate is limited the amount of magnesium associated with it must fall below the normal (as is the case in the present series of experiments). Moreover, the behavior of the precipitant is quite in accord with the hypothesis; for, though the influence of an excess of the soluble phosphate would naturally tend (as was observed) in the same direction as that of the ammonium salt and free ammonia, viz, to the production of the phosphate deficient in magnesium, the tendency of an excess of the magnesium salt must obviously be to increase the amount of magnesium in the phosphate. The hypothesis fits the facts, therefore, on both sides; and, if precipitation is practically complete (as was shown to be the case throughout), the argument for the existence of an ammonium magnesium phosphate—poorer than the normal salt in magnesium—possibly the salt $(NH_4)_4Mg(PO_4)_2$—seems to be strong."

In discussing the practical application of these results, attention is called to a method of determining magnesia proposed by Wolcott Gibbs,[1] in which the solution of magnesium salt is boiled with microcosmic salt, and ammonia added after cooling. In this method, which the authors consider very accurate, as well as in that of precipitation in the cold followed in the above investigations, it is recommended to use faintly ammoniacal solutions and wash water.

> "Our experiments go to show that good results may be expected when the solution of the phosphate, containing a moderate excess of the magnesium salt and not more than 5 to 10 per cent of ammonium chlorid, is precipitated by making it slightly ammoniacal, the precipitate being washed in slightly ammoniacal wash water. In general, however, and especially when more ammonium chlorid than this proportion, or more magnesium salt than twice the amount theoretically necessary is present, it is safer to decant the supernatant liquid from the precipitate (through the filter to be used subsequently to hold the phosphate), to dissolve the precipitate in a little hydrochloric acid and reprecipitate by dilute ammonia, washing with faintly ammoniacal wash water."

---

[1] Amer. Jour. Sci., 3. ser., 5 (1873), p. 114.

The magnesia mixture used in these experiments "was prepared by dissolving 55 gm. of magnesium chlorid in as little water as possible and filtering, mixing with this solution 28 gm. of ammonium chlorid purified by treating it in strong solution with bromin water and a slight excess of ammonia, filtering, diluting to 1 liter, and, after standing for some hours, filtering again."

The solubility of Thomas slag in citric acid solutions, E. HOTTER (*Jahrb. Pom. Landes Vers. u. Samen Control Sta., Graz, 5 (1897), pp. 29-32*).—Comparisons of the solubility of various samples of Thomas slag in Wagner's ammonium citrate; 1.25, 1.4, 2, and 4 per cent citric acid; and 1, 5, and 10 per cent acetic acid are reported. The 1.25 per cent citric acid solution gave results which agreed closely with those obtained by the Wagner method. The solubility increased with the strength of the citric acid solution used, a 4 per cent solution dissolving nearly the total amount of phosphoric acid present. The solubility in 10 per cent acetic acid was nearly the same as in Wagner's ammonium citrate. In the author's opinion it is a matter of indifference, therefore, whether the solubility of slag is determined by the Wagner or Passon method, or by the use of solutions of other organic acids. He prefers, however, a solution of citric acid not stronger than 4 per cent. The method proposed is as follows: Place 5 gm. of the slag in a one-half liter flask and fill to the mark with citric acid. Shake continuously for 30 minutes, allow to stand one-half hour, and filter rapidly. To 15 cc. of the filtrate add 50 cc. of Maercker's solution and 20 cc. of magnesia mixture, and stir vigorously for 30 minutes.

The estimation of potash, E. W. BELL (*Chem. News, 79 (1899), No. 2052, pp. 135, 136*).—The following method is proposed:

"In the case of manures, carefully boil 5 or 10 gm. of the sample with about 150 cc. of water with or without the addition of a little hydrochloric acid. Add ammonia in sufficient quantity to produce a slight alkalinity; then, without filtering, add a considerable excess of barium carbonate (usually about double the weight of manure taken) and continue the boiling for half an hour. Filter the mixture, wash the precipitate, and make up the filtrate and washings to 500 cc.

"Evaporate from 50 to 100 cc. of the solution to dryness with the addition of a small quantity of ammonium oxalate, ignite gently, treat with hot water, and filter, evaporate the filtrate with hydrochloric acid and platinum chlorid, and complete the determination in the usual way.

"In the case of soils, either the hydrochloric solution of the soil may be used (if K_2O soluble in HCl is required), and after being rendered alkaline by means of ammonia, treated with barium carbonate, etc., as above, or the soil may be moistened with strong sulphuric acid, gently ignited, and the residue, after boiling with water, treated with barium carbonate, the boiling continued, filtered, and a portion of the filtrate then evaporated directly with hydrochloric acid and platinum chlorid, without any previous addition of ammonium oxalate and ignition.

"For the estimation of potash in vegetable substances, the organic matter should be moistened with sulphuric acid, ignited, and treated in a similar manner to soil."

The method gave very satisfactory results on fertilizer mixtures of known and unknown composition.

Estimation of the perchlorate in Chile saltpeter, C. AHRENS and P. HETT (*Ztschr. Öffentl. Chem., 4 (1898), p. 445; abs. in Chem. News, 79 (1899), No. 2050, p. 110*).—The following method is recommended as sufficiently rapid and accurate for commercial purposes:

"Twenty grams of the well-powdered substance is placed in a platinum crucible and moistened with 2 or 3 cc. of a cold saturated solution of carbonate of soda; add 1 gm. of binoxid of manganese free from chlorin and evaporate to dryness. The mass is brought to fusing point, and the crucible, which must be well covered, is kept at red heat for 15 minutes. The product of this fusion is, after cooling, dissolved in 100 cc. of boiling water, the solution is cooled and made up to 250 cc.; of this when filtered 50 cc. is taken (equal to 4 gm. of the sample), acidulate with 10 or 15 cc. of nitric acid of 1.2 density, then add a 1 per cent solution of permanganate of potash until the red color lasts for at least a minute. Then add ferrous sulphate and titrate the solution by Volhard's method.

"The chlorin is also determined in 4 gm. of the sample by Volhard's method. From the difference between the number of cubic centimeters of decinormal silver solution employed after fusion and the number obtained before fusion we calculate the chlorin which exists in the saltpeter in the state of perchlorate.

"The addition of carbonate of soda before fusion is simply to prevent the partial volatilization of the hydrochloric acid. The addition of the binoxid of manganese facilitates the decomposition of the perchlorate; and finally the treatment with permanganate has for its object the elimination of the nitrous acid, and the transformation into iodate, of the small quantity of iodin which is present in the sample in the state of iodid."

A simple method for determining combined carbon dioxid, especially that in the form of calcium carbonate, in the soil, A. STUTZER and R. HARTLEB (*Mitt. Landw. Inst. Breslau, 1899, No. 1, pp. 101-105*).—The method proposed is as follows: Ammonium chlorid, 5 gm. to each 0.5 gm. of calcium carbonate present, is mixed with soil in an Erlenmeyer flask of Jena glass; the mixture is covered with 200 cc. of distilled water and boiled for 45 minutes, the distillate being collected in standard sulphuric acid. By this process the carbonates of calcium, etc., are converted into ammonium carbonate, which is carried over in the distillate and may thus be determined by titration. When iron carbonate is present, its influence upon the results may be destroyed by previously boiling the soil with water before adding the ammonium chlorid. Iron oxids were found to have no effect upon the results.

Determination of humus in soil, C. ASCHMAN and H. FABER (*Chem. Ztg., 23 (1899), No. 7, p. 61; abs. in Analyst, 24 (1899), No. 277, pp. 103, 104*).—Boil 25 gm. of the air-dry, finely sifted soil for 1 hour in a water bath with 100 cc. of sodium hydroxid (50 gm. per liter). For complete extraction of the humus acids it is necessary to decant the solution and repeat the digestion several times. Make the volume to 510 cc. (10 cc. being allowed for the volume of the soil), mix carefully, and allow to stand until the solution has become perfectly clear. To 5 cc. of this solution diluted with 100 cc. of water, add potassium permanganate solution (0.32 gm. per liter) gradually until no color appears when the solution is boiled for some time. After 5 minutes add 10 cc. of oxalic acid (0.63 gm. per liter) and carefully run in the permanganate solution until the end reaction is obtained.

A correction is made for the permanganate solution reduced by the oxalic acid used, which is determined by a preliminary test, as follows: To 5 cc. of the permanganate add 10 cc. of sulphuric acid (1:5), dilute to 100 cc., and boil for 5 minutes. Add 10 cc. of the oxalic acid and titrate.

Methods for the determination of color and the relation of the color to the character of the water, F. S. Hollis (*Jour. New England Water Works Assoc., 13, pp. 94–111; abs. in Tech. Quart., 12 (1899), No. 1, Rev. Chem., p. 14*).—"The author shows by a series of analyses, extending over a year, that in an unpolluted surface water the variations in oxygen consumed, loss on ignition, and albuminoid ammonia, in general, follow the changes in color. Among the methods for the determination of color are described the Tidy colorimeter, the Nessler scale of Leeds, the method based on a comparison of the natural waters with the Lovibond tintometer (erroneously spelled Lovi*bard*), the platinum scale of Hazen, and the special form of colorimeter used at the experimental filter station of the Boston waterworks. A table is given for the conversion of color readings from the Nessler and natural water standard to the platinum standard."

The examination of butter, A. Zega (*Chem. Ztg., 23 (1899), No. 29, p. 312, figs. 5*).—One cubic centimeter of the melted and filtered fat is shaken with 20 cc. of a mixture of 6 parts ether, 4 parts alcohol, and 1 part glacial acetic acid, in a tightly closed cylinder, and this cylinder is then allowed to stand in water at 15 to 18° C. With pure butter the liquid remains clear, and only after standing from 1 to 1½ hours will small crystals form. With oleomargarine, however, the crystals will form in from 1 to 2 minutes and will settle as a precipitate, while with mixtures of butter and oleomargarine in varying proportions the little crystals form in varying lengths of time. These crystals can be readily distinguished under the microscope. Illustrations show the several forms of crystals.—J. T. ANDERSON.

The constituents of the seeds of Picea excelsa and the cleavage products of the proteids, N. Rongger (*Landw. Vers. Stat., 51 (1898), No. 2–3, pp. 89–116*).—The seeds of this spruce were studied qualitatively with reference to the different classes of constituents, and were submitted to quantitative analysis. The composition is given as follows:

Composition of seeds of European spruce.

	Per cent.
Albuminoids	15.89
Nuclein and other undigestible nitrogenous compounds	3.23
Glycerids (and free fatty acids)	35.13
Cholesterin, less than	.06
Lecithin	.12
Water-soluble nitrogen-free extract (carbohydrates, organic acids, etc.)	5.43
Water-soluble nitrogen-free extract	7.00
Crude fiber	25.40
Ash	4.74
Undetermined (difference)	3.00
	100.00

A study of the cleavage products of the protein showed that about one-third of the protein was in the form of organic bases, and that of this a large proportion was arginin.

A compendium of toxicology, L. LEWIN (*Lehrbuch der Toxikologie. Vienna and Leipsic: Urban & Schwarzenberg, 1897, 2. rev. ed., pp. 509, pl. 1, figs. 7*).—This volume consists of a general treatise on the subject of poisons, and discusses under various headings, inorganic poisons, organic poisons, poisonous plants, poisonous animals, and poisons due to metabolic processes.

Analysis of superphosphates, M. ZECCHINI (*Staz. Sper. Agr. Ital., 31 (1898), No. 1-2, pp. 165-178*).—This is mainly an account of comparative tests of the Petermann and Martinotti modification (see below) of the Italian official or modified Appiani[1] methods.

The determination of phosphoric anhydrid soluble in water and citrate, F. MARTINOTTI (*Staz. Sper. Agr. Ital., 31 (1898), No. 1-2, pp. 160-164*).—The method proposed is as follows: Add about 100 cc. of distilled water to 5 gm. of substance in a 250 cc. flask. Neutralize with soda solution, add 100 cc. of neutral ammonium citrate, make volume to 250 cc., and shake in a rotary apparatus for 1 hour. To 50 cc. of the filtered extract thus obtained, add a few drops of nitric acid and heat for about 10 minutes in a water bath to convert metaphosphates into orthophosphates. Cool and add 100 cc. of water, 25 cc. of ammonia (0.92 sp. gr.), and 50 cc. of magnesia mixture. Stir for some time and allow to stand 5 to 6 hours before filtering.

Methods of soil analysis adopted by the agricultural experiment stations and laboratories of France (*Méthodes d'analyse des terres du comité consultatif des stations agronomiques et des laboratoires agricoles. Paris, pp. 45*).

On the analysis of nitrites, G. LUNGE (*Ztschr. Angew. Chem., 1899, No. 16, p. 369*).

Determination of nitrates and ammonia in water, F. X. MOERK (*Amer. Jour. Pharm., 71 (1899), p. 157; abs. in Chem. Ztg., 23 (1899), No. 36, Repert., p. 129*).

A volumetric method for determining boric acid, L. C. JONES (*Ztschr. Anorgan. Chem., 20 (1899), No. 3, pp. 212-220*).

The surface tensions of aqueous solutions of alkaline chlorids, C. E. LINEBARGER (*Jour. Amer. Chem. Soc., 21 (1899), No. 5, pp. 411-415, figs. 2*).

A new and simple method of distinguishing butter and margarin (*Abs. in Jour. Hyg., 24 (1899), No. 1182, p. 160*).—The spots left from the evaporation of drops of ethereal solutions of these substances are said to furnish differential characters.

Artificial and natural indigo (*Jour. Franklin Inst., 147 (1899), No. 5, p. 403*).

On the reducing and invert sugars of maize stalks, C. ISTRATI and G. OETTINGER (*Compt. Rend. Acad. Sci. Paris, 128 (1899), No. 17, pp. 1040-1043*).

On the rotary power of sugar, E. MASCART and H. BÉNARD (*Ann. Chim. et Phys., 7. ser., 17 (1899), May, pp. 125-144*).

On the standardized saccharimeter, B. WEINSTEIN (*Ztschr. Angew. Chem., 1899, No. 16, pp. 369, 370*).

Some new laboratory apparatus, M. KAEHLER and MARTINI (*Ztschr. Angew. Chem., 1899, No. 16, p. 372, figs. 3*).—Distillation apparatus and a weighing tube are described.

BOTANY.

The poisonous plants in New Jersey, B. D. HALSTED (*New Jersey Stas. Bul. 135, pp. 28, figs. 10*).—The author considers the poisonous plants under the heads of those poisonous to man and animals when eaten, and those poisonous by contact. Among those poisonous to man when eaten are mentioned the water hemlock, poison hemlock, wild parsnip, thorn apples, black nightshade, bitter-sweet, poke root, lobelias, false hellebore, and bouncing Bet. A number of poisonous fruits, seeds, and flowers are enumerated, and an extensive list is given of plants whose underground parts are more or less poisonous. Among the flowerless plants mentioned as poisonous are *Amanita muscaria, A. phalloides*, and *A. verna.*

---

[1] Staz. Sper. Agr. Ital., 28 (1895), p. 817.

Of the plants poisonous to live stock, the author mentions false hellebore, narrow and broad leaved laurels, *Leucothœ* spp., staggerbush, rattlebox, wild cherry, corn cockle, cocklebur, water hemlock, green potatoes, sneezeweed, ergot, etc.

Among the plants poisonous to the touch are mentioned the poison ivy, poison sumac, various euphorbias, and lady's slipper. An extensive list is also given of plants that are considered somewhat poisonous.

Classification of fruits, L. NICOTRA (*Bul. Soc. Bot. Ital., 1898, pp. 115–122, 204–212; abs. in Jour. Roy. Micros. Soc.* [*London*], *1899, No. 2, pp. 172, 173*).—The author suggests certain changes in the terms at present applied to the different kinds of fruits. He proposes the term holocarp for an entire fruit resulting from a number of carpels, the product of each carpel being called a mericarp. Depending on the degree of concrescence of the carpels, a holocarp may be an apocarp or a syncarp, but these two forms pass into one another. According to the arrangement of the carpels in a spiral or in a whorl, a holocarp may be helicocarpic or actinocarpic, and according to the position of the placentæ, it is pleurospermic or antispermic. A caryopsis is said to differ but slightly from an achene. The author regards the follicle as probably a primordial carpological type from which are derived, in various directions, the legume, the single-seeded indehiscent achene, the silique, and the various forms of capsule.

Experiments in the autumn coloring of plants, E. OVERTON (*Nature, 59* (*1899*), *No. 1526, p. 296*).—While engaged on some osmotic experiments, the author observed that newly-formed leaves of *Hydrocharis morsus-ranæ*, which had been placed several days previous in a weak solution of cane sugar, assumed a rich reddish-brown color, although otherwise perfectly normal. Further experiments showed that the culture of these plants in solutions of cane sugar, grape sugar, and fructose constantly had this effect on the coloring of those leaves which were developed during the time the specimens were in the solutions, and that leaves which were fully developed before the commencement of the experiments gradually assumed the same reddish-brown hue. Salt solutions and solutions of organic compounds other than carbohydrates had no such effect on these plants, and even among the sugars galactose was without effect. Lactose acts only after a long period, the effect obtained being slight and is probably due to hydrolysis. The color in these leaves is said to be due to the appearance of red cell sap in the pallisade cells and those cells lining the air chambers of the leaf.

Lidforss[1] and the author independently found that during the winter leaves are entirely devoid of starch, but contain large quantities of sugar. The remarkable coincidence of the appearance of red cell sap with the increase of sugar in autumn and its disappearance in spring formed a starting point for a considerable number of experiments on the formation of red pigment of leaves.

From these experiments the author concludes that the red coloring matter of green plants is probably in the nature of a glucosid, in most cases a union of tannin compounds with sugar. The chief physical factors in their production are sunshine, which augments assimilation in the production of sugar while accelerating the chemical process which leads to the formation of pigment, and a low temperature, which prevents the conversion of sugar into starch. In other words, the red autumnal tints are in a great measure the direct result of the autumnal climatic conditions. The author states that it is possible in many plants to produce red autumnal tints at any time of the year by feeding them with glucose. Generally speaking, this artificial production of red cell sap is possible only where the natural reddening of the leaf has its seat in the mesophyll cells. In cases where the coloration is in the epidermis, all experiments with glucose were unsuccessful.

Among the plants which were found especially favorable for experiment the author mentions *Lilium martagon*, *L. candidum*, *L. umbelliferum*, *Ilex aquifolium*, and numerous succulent and water plants, such as *Saxifraga crassifolium*, *Hydrocharis morus-ranæ*, and different species of Utricularia.

A full account of these experiments has since appeared in the *Jahrbücher für Wissenschaftliche Botanik, 33 (1899), No. 2, pp. 171-231.*

Observations on stomata, F. DARWIN (*Proc. Roy. Soc. London, 63 (1898), No. 400, pp. 413-417*).—The author reports on a series of observations conducted with a form of hygroscope to determine the opening and closing of stomata. The principle of the hygroscope used is based upon the fact that in adult leaves transpiration is stomatal rather than cuticular. The index of the hygroscope is made of shavings of pressed and heated horn; and the instrument was insensitive to cuticular transpiration, so that any movements of the index must depend on transpiration through the stomata. The hygroscope is said to show the gradual closure of stomata that occurs when a plucked leaf withers. Contrary to the general statement that marsh and aquatic plants do not close their stomata under these circumstances, the author found that there was a partial closing in aquatic plants, although it was much less marked than in the case of terrestrial ones. Another interesting fact noted in the withering of leaves is that in many cases the closing of the stomata is preceded by a temporary opening, which may occur almost simultaneously with the severing of the leaf from the plant.

A series of experiments was conducted to ascertain the comparative effect of moist and dry air, in which it was found that the stomata closed before there were any visible signs of flaccidity in the leaf. When leaves were exposed to air dried by sulphuric acid the closing was preceded by a remarkably long opening of the stomata.

---

[1] Bot. Centbl., 68 (1896), p. 33.

Experiments with gases and vapors showed that chloroform and ether as well as pure carbon dioxid slowly close the stomata.

The fact that stomata are wide open in sunshine is said to be well known, but the difference between bright and somewhat diffused light is not so well known, nor is the fact that in dark, stormy weather the stomata may remain nearly closed during the day, even in summer.

The effect of differences in illumination is well shown by the investigation of a number of leaves which have stomata on both their surfaces. In these the stomata on the illuminated surfaces are much wider open than on the less brightly illuminated sides, and when the plant is reversed in position the stomata rapidly accommodate themselves to the change in illumination. One of the most interesting facts brought out in the experiments is in regard to the effect of artificial darkness. It is more effectual in producing closure in the afternoon than in the morning; and conversely, illumination opens closed stomata more readily in the morning than later in the day. These facts taken together with other observations tend to show a certain amount of inherent periodicity in the nocturnal closure of stomata.

The question as to whether or not the majority of plants close their stomata at night was investigated and the author concludes that in terrestrial plants, excluding nyctitropic plants, the great majority show some closure at night. On the other hand, the hygroscope shows widely opened stomata on most aquatic plants. The author partially agrees with Stahl in that nyctitropic plants are remarkable for not closing their stomata at night.

Since the hygroscope gives numerical readings it is possible to represent graphically the daily opening and closing of stomata. The curve begins to leave zero with the morning light, rises rapidly at first and afterwards more slowly. In some cases it remains almost horizontal until a rapid fall begins in the evening. In every case there is a slow rise to the highest point, which occurs between 11 a. m. and 3 p. m. The hygroscope generally sinks to zero within an hour after sunset.

The effect of heat has not been fully investigated, but enough has been done, the author states, to confirm previous observations, which show that heat opens stomata. In regard to the visible spectrum the author finds that red rays are decidedly most efficient in opening the stomata, but he is not able to find any evidence of a secondary maximum in the blue.

The biology of the noctural closure is briefly discussed, and it is suggested that the gaseous interchange of assimilation may require widely open stomata, whereas respiration may be carried on with comparatively closed apertures. If this be true, the stomata might to a great extent be closed at night and an economy in the use of water effected without detriment to metabolism. Observations show that as long as the stomata are open the transpiring leaf is considerably cooler than the dry bulb thermometer, but at night it has almost the temperature of the air. In this way there is undoubtedly a considerable saving of heat, but whether it is sufficient to be of practical importance to the plant the author is unable to state. The mechanism of the stomata is briefly described, and the author suggests that there is a necessity for further studies on this, especially from the point of view of irritability.

Stopped stomata, T. WULFF (*Oesterr. Bot. Ztschr., 48 (1898), pp. 201–208, 252–258, 298–307, pl. 1; abs. in Jour. Roy. Micros. Soc. [London], 1899, No. 2, p. 175*).—The author finds the closing of stomata by a layer of wax, which has heretofore been chiefly observed in the conifers, to be a widely spread phenomenon, the evident object being the reduction of transpiration. The transpiration of conifers as compared with that of angiosperms is about in the proportion of 1:6, and is largely due to this cause. When the stomata are not closed on the outside, the same result is obtained through a partial closing of communication between the pore and the internal air chamber by deposits of round or angular granules of wax. These appear to be formed from the guard-cells or from the epidermal cells contiguous to them. While hindering transpiration to a great extent, this layer of wax is said not to interfere with the diffusion of carbon dioxid. In all succulent plants examined, the stomata were entirely free from wax, but the phenomenon was found very common among the grasses.

Healing tissue in plants, M. J. MASSART (*Mem. Acad. Roy. Belgique, 1898, pp. 68, figs. 57; abs. in Jour. Roy. Micros. Soc. [London], 1899, No. 1, pp. 15, 16*).—The various modes in which wounds are healed in plants are described in detail Among the algæ and fungi the methods are comparatively simple, although many do not seem to have the power of repairing injuries. This applies in general also to the mosses and ferns. Among phanerogams there are two chief processes which take place in the adjacent tissue. There is an elongation of the meristematic cells toward the wound, together with the formation of numerous walls parallel to the surface and the formation of cork. It is said that a direct division of the nucleus always takes place in the phello gen of a wound. The spread of the irritation caused by a wound is very slow, since dead elements, such as vessels and fibers, do not conduct the stimulus. The author believes that a chemical process underlies the propagation of the irritation. The formation of cork over a wound is promoted by the drying up of the surface of the wound.

Mucilaginous epiderm of leaves, O. KRUCH (*Ann. Inst. Bot. [Rome], 6, pp. 191–271, pls. 2; abs. in Jour. Roy. Micros. Soc. [London], 1899, No. 1, p. 16*).—The presence of a mucilaginous epiderm in dicotyledons is said to be of quite common occurrence, frequent examples occurring in the order of Rosaceæ. It takes the form of a mucilaginous layer on the inner or on both the inner and outer walls of epidermal cells. The formation of mucilage seems to have a direct connection with assimilation, since it occurs only in cells which are in direct contact with assimilating cells. It never takes place on the lateral walls of epidermal cells, and when the epiderm consists of several layers it is confined to the inner walls of the lowermost layer. The property of secreting mucilage does not belong to all epidermal cells, but only to certain ones which are variously distributed.

In the Rosaceæ the mucilage always takes the form of a secondary thickening of the wall separated from the protoplasm by a layer of cellulose. The author regards the mucilage layer as a reservoir of water to protect the surface against excessive transpiration.

The winter condition of the reserve food substances in the stems of certain deciduous trees, E. M. WILCOX (*Amer. Jour. Sci., 4. ser., 6 (1898), No. 31, pp. 69–74*).—Investigations have been undertaken to determine more definitely some of the essential physiological processes involved in the dormant period of woody plants. Stated briefly, the problem is to determine what are the conditions in which the reserve food substances are stored in the twigs during the dormant period; what, if any, changes they undergo during this period, and how these changes affect the renewal of activity by the buds at the beginning of the subsequent season of growth.

The author points out that the phenomena of renewal of activity by buds does not essentially differ from that of germination of seeds, and states that both phenomena may well be classed under one head, the germination of dormant organs.

The work of a number of investigators on this subject is briefly reviewed, and a report is made of the studies so far conducted, which have been largely confined to the question of starch formation and distribution and its relation to the growth of the tree. Some 25 or more species of deciduous plants have been studied, and the details of collection and preparation of material are given at considerable length.

In this preliminary paper the facts observed in a study of *Liriodendron tulipifera* and *Pyrus malus* are given in detail, and with slight modification the results will hold good for the other species examined. The author finds that there is a general movement of starch from the more peripheral and exposed regions to the more deep-seated and protected regions of the stems during the winter, and a return again in the spring to the cortex and the regions of growth.

Further studies are to follow on the condition of starch and other substances throughout the entire year. Two essential questions are being studied in connection with this subject—the determination of the behavior of leucoplastids in the starch-bearing cells in the stems of deciduous trees during the period of dormancy, and the part which the intercommunicating threads of protoplasm play in the transmission of starch.

Experiments on the transpiration of plants, A. PAGNOUL (*Bul. Sta. Agron. Pas de Calais, 1898, pp. 10–15, fig. 1*).—Experiments are reported in which fescue grass was grown from March 30 to June 21 under almost identical circumstances as to conditions, the only difference being that one pot was filled with a poor clay soil without fertilizer, and the other with a rich calcareous soil to which dried blood and nitrate of potash were added. The same degree of saturation of soil was constantly maintained. The grass was cut May 2, 27, and June 21, weighed and analyzed. The results obtained are tabulated. It appears that during the first period, 33 days, the plants in the poor soil transpired 1,190 gm. of water per gram of dry weight, as compared with a transpiration of 555 gm. in the rich soil. In the second period the figures were 1,053 and 581 gm. of water per gram of dry weight, and for the last period 1,084 and 585 gm., respectively. The nitrogen content of the product of each pot was determined, and it was found that for each gram of nitrogen in the product of the poor soil 46 kg. of water was transpired, while in the rich soil 1 gm. of nitrogen was found for each kilogram of water given off.

Sap pressure, W. FIGDOR (*Oesterr. Bot. Ztschr., 18 (1898), No. 9, pp. 359, 360; abs. in Jour. Roy. Micros. Soc. [London], 1899, No. 2, p. 179*).—According to the author, the phenomena of sap pressure differ widely in temperate and tropical climates. In Java, where these investigations were conducted, there is always, in contrast to the prevalent conditions in temperate climates, a positive sap pressure which varies greatly in intensity in different plants. In one instance a pressure of more than 8 atmospheres was noted, and not infrequently pressures as great as three times those in temperate climates were recorded. The sap pressure in a given plant may vary greatly in the course of 24 hours, these variations being due not only to periodicity but also to external factors, such as transpiration.

Observations on the action of anesthetics on vegetable and animal protoplasm, J. B. FARMER and A. D. WALLER (*Proc. Roy. Soc. London, 63 (1898), No. 395, pp. 213–216, dgms. 3*).—The authors conducted a series of experiments to observe simultaneously and comparatively the effect of certain anesthetics on vegetable and animal protoplasm. Two gas chambers were arranged through which anesthetic and other vapors could be passed, the first containing a leaf of *Elodea canadensis*; the other the sciatic nerve of a frog. The movements of the chlorophyll bodies in the leaf cells were observed and measured by one of the authors, while the other watched the readings of the deflections of the galvanometer. The several series of experiments are reported, from which it appears that the action of carbon dioxid was to produce an initial slight acceleration, followed speedily by a complete cessation of movement. If the carbon dioxid apparatus was disconnected and air passed through the cells the protoplasm in a few minutes began to show signs of recovering. At first the movement was very slight. Later the movement was accelerated until the motion became more rapid than normal. This was followed by slowing down to the normal speed. The nerve showed itself under the conditions of this experiment somewhat less sensitive to carbon dioxid than the plant, and the latter was still less sensitive than the active plasmodium of a myxomycete.

Ether vapor passed over the plant for 2 minutes caused a speedy arrest of all movements and a quiescent condition which persisted for some minutes. Recovery then ensued and the normal rate of movement was slowly regained. If the ether vapor was insufficient to anesthetize the nerve protoplasm, circulation was unaffected. The action of chloroform proved to be far more deadly than that of ether, all movement being arrested in less than a minute, and in 2 minutes causing death of the cell. When a much more diluted vapor of chloroform was passed over the cell for 2 minutes recovery ultimately occurred. The action of ether and chloroform, especially the latter, was very marked in causing many of the chlorophyll granules, which had been previously almost restricted to the latter walls, to become dispersed throughout the cell.

On the influence of anesthetics on the formation of chlorophyll, E. C. TÉODORESCO and H. COUPIN (*Compt. Rend. Acad. Sci. Paris, 127 (1898), No. 22, pp. 881–887*).—Experiments with wheat, vetch, white lupine, and buckwheat are reported in which series of plants were grown under bell jars, different amounts of ether and chloroform being added to the moist atmosphere.

The quantity of anesthetics used was not sufficient to destroy the plants, the object being to investigate their retarding influence on the plants. The different seedlings used in the experiment were etiolated, having been grown in the dark, and after being placed in the bell jars were exposed to sunlight. It was found that the anesthetics were able for some time to prevent the production of chlorophyll in etiolated plants after being placed in the sunlight. If the amount of anesthetic was considerably reduced, the production of chlorophyll would be somewhat retarded, but would take place slowly. It was further found that the amount of the same anesthetic which, without killing the plant, produced a maximum effect on one plant varied within narrow limits on others.

Chlorophyll assimilation of Limodorum abortivum, M. E. GRIFFON (*Compt. Rend. Acad. Sci. Paris, 127 (1898), No. 23, pp. 973–976; abs. in Jour. Roy. Micros. Soc. [London], 1899, No. 2, pp. 178, 179*).—This terrestrial orchid is regarded as intermediate between those which have green leaves and which also possess a mycorrhiza and the nonchlorophyllous saprophytic species. Although this plant contains an abundance of chlorophyll, the chloroleucites are masked by a great quantity of a violet pigment in the stem, leaves, and all parts of the plant, and as a consequence it has but little power of decomposing carbon dioxid directly. On this account the respiration is said to be considerably in excess of the assimilation.

Action of gases on the currents of protoplasm and on cell division, P. SAMASSA (*Verhandl. Naturhist. Ver., Heidelberg, 6 (1898), No. 1; abs. in Jour. Roy. Micros. Soc. [London], 1899, No. 2, p. 169*).—From experiments conducted with the staminal hairs of Tradescantia, pure oxygen was found not to accelerate the circulation of the protoplasm, while hydrogen and carbon dioxid caused its complete suspension. When no oxygen is present, the division of the nucleus does not take place. No cyclosis of the protoplasm is exhibited in the terminal cells of the hairs while dividing.

Variation in Indian corn when brought from New York to Texas, H. NESS (*Trans. Texas Acad. Sci., 2 (1898), No. 2, pp. 73-78*).—In 1896 two varieties of sweet corn were planted at Cornell University, Ithaca, New York, and at College Station, Texas, and comparisons made at the end of the growing seasons. The same experiment was repeated the next season, 14 varieties of corn being planted in the two different places, and kernels from the same ears used in each case. A marked difference was noted in the height of the stalks, length and width of leaves, number of suckers, and number of ears produced. At the Texas Station there was a very great tendency on the part of all varieties of sweet corn to produce grains without the characteristic wrinkling.

The measurements of the different varieties are given in tabular form, from which it appears that in nearly every case the stalks of the Texas-grown corn were about one-fourth shorter than those grown in New York, the leaves were narrower and shorter, there were a greater number of suckers, and the ears were somewhat larger and more numerous.

In accounting for these differences, the author states that the variation could not be attributed to differences in temperature, soil, moisture, or rainfall, since they were practically the same for the growing period in the two places; but he thinks the difference is due to intensity of light, which is much greater in Texas than New York. He concludes that the main cause of the decrease in the size of stalks and leaves, and increase in the number of ears of Indian corn when brought from northern to southern latitudes, is the increased intensity in the light, and perhaps also the relatively greater increase of the more highly refrangible rays of light.

Grasses, E. A. SMYTH (*Virginia Sta. Bul. 81, pp. 101-114, figs. 6*).—Popular descriptions are given of the principal characteristics of grasses, nature of their flowers, and the relationships of the better known grasses which are found in the State.

Statistical summary of spontaneous hybrids in the flora of Europe, E. G. CAMUS (*Statistique sommaire des faits d'hybridité constatés dans l'etendue de la flore Européenne, 1897, pp. 12*).—A catalogue of hybrids.

Plants reputed poisonous to stock, F. M. BAILEY (*Agr. Jour. Queensland, 4 (1899), No. 4, p. 285, pl. 1*).—Describes *Pratia erecta*, a lobeliaceous plant reputed as very poisonous to sheep.

Notes on the botany of cotton. Varieties of cotton grown in Egypt and the climatic conditions which affect them, G. P. FOADEN (*Jour. Khedivial Agr. Soc. and*

School Agr., 1 (1899), No. 2, pp. 49–67).—General notes are given on the botany of the varieties of cotton grown in Egypt, and of the varieties most in cultivation. The American sea island (*Gossypium barbadense*) seems to have been the original.

Contributions to the life history of the genus Gnetum, J. LOTSY (*Ann. Jard. Bot. Buitenzorg, 16 (1899), pt. 1, pp. 46–114, pls. 10*).

Conspectus of the genus Lilium, F. A. WAUGH (*Bot. Gaz., 27 (1899), Nos. 4, pp. 235–254; 5, pp. 340–360, figs. 14*).—A revision is given of the wild and cultivated species of this genus, 64 species being recognized.

Revision of the genera Montanoa, Perymenium, and Zaluzania, B. L. ROBINSON and J. M. GREENMAN (*Proc. Amer. Acad. Arts and Sci., 34 (1899), No. 20, pp. 507–534*).

Synopsis of the genus Verbesina, with an analytical key to the species, B. L. ROBINSON and J. M. GREENMAN (*Proc. Amer. Acad. Arts and Sci., 34 (1899), No. 20, pp. 534–566*)

On the variation in Picea excelsa, C. SCHRÖTER (*Ueber die Vielgestaltigkeit der Fichte (Picea excelsa). Zurich: Fäsi & Beer, 1898, pp. 130, pl. 1, figs. 37*).

Poisonous toadstools, B. D. HALSTED (*Amer. Gard., 20 (1899), No. 231, pp. 380, 381, figs. 2*).—Notes on *Amanita muscaria, A. phalloides,* and *A. verna.*

Poisoning due to mushrooms and means to be adopted against it, G. ARCANGELI (*Atti R. Accad. Econ. Agr. Georg. Firenze, 4. ser., 21 (1898), pp. 25; abs. in Bot. Centbl., 78 (1899), No. 5, pp. 132, 133*).—Notes are given of *Amanita phalloides, A. pantherina, A. muscaria, Armillaria tumescens, Boletus luridus, B. satanus,* etc., and suggests antidotes as far as known.

Plant anatomy from the standpoint of classification, C. GUFFROY (*Bul. Soc. Bot. France, 45 (1898), Nos. 6–8, pp. 337–341*).

The dehiscence of the nutmeg fruit, J. M. JANSE (*Ann. Jard. Bot. Buitenzorg, 16 (1899), pt. 1, pp. 17–45, pl. 1*).

Studies on subterranean organs. I, Compositæ of the vicinity of Manhattan, Kansas, A. S. HITCHCOCK (*Trans. Acad. Sci. St. Louis, 9 (1899), No. 1, pp. 8, pl. 1*).

The relation of plant physiology to the other sciences, J. WIESNER (*Die Beziehungen der Pflanzenphysiologie zu den anderen Wissenschaften. Vienna: A. Hölder, 1898*).

Notes on the chemical physiology of the trunks of trees, H. J. J. VANDEVELDE (*Bot. Jaarb. Kruid. Genotsch. Dodonæa, Ghent, 10 (1899), pp. 14, pls. 3*).

On the physiological importance of furfuroids in the plant, J. STOKLASA (*Bot. Centbl., 78 (1899), Nos. 6, pp. 161–170; 7, pp. 193–203*).

Phytochemical notes, P. VAN ROMBURGH (*Ann. Jard. Bot. Buitenzorg, 16 (1899), pt. 1, pp. 1–16*).—Preliminary notes are given on the occurrence of acetone, methyl salicylate, methyl alcohol, and hydrocyanic acid in a number of plants, and of methyl cinnamate in *Alpinia malaccensis.*

Investigations concerning the occurrence of red cell sap in plants, E. OVERTON (*Jahrb. Wiss. Bot., 33 (1899), No. 2, pp. 171–231*).—See E. S. R., 11, p. 113.

Selective absorption of mineral elements by plants, M. E. DEMOUSSY (*Compt. Rend. Acad. Sci. Paris, 127 (1898), No. 23, pp. 970–973; abs. in Jour. Roy. Micros. Soc. [London], 1899, No. 2, pp. 179, 180*).—It is stated that the author by growing very young plants in dilute mineral solutions was able to determine their selective power in the absorption of certain mineral elements. It was found among other things that the presence of potassium will greatly lower and even reduce to zero the absorption of sodium.

Nitrogen assimilation (*Agr. Dept. Univ. Col., Nottingham [and] Midland Dairy Inst., Kingston, 1898, pp. 4, pl. 1*).—Contains and account of experiments in sand cultures on beans and clover.

Can the agriculturist profitably use Alinit as a fertilizer? KLOEPFER (*Ztschr. Landw. Ver. Rheinpreussen, n. ser., 16 (1899), No. 15, p. 133*).—From data collected from various sources in which Alinit had been applied to more than 6,000 morgen, the author concludes it is impracticable to use it as a fertilizer.

On the influence of fungi on the form and characters of plants, T. MEEHAN (*Proc. Acad. Nat. Sci. Philadelphia, 1899, pt. 1, pp. 108–110*).—Notes the modification in Euphorbias and Hepatica by Æcidium so that specific characters were obliterated.

Spore formation in Dematium pullulans, F. WELEMINSKY (*Centbl. Bakt. u. Par., 2. Abt., 5 (1899), No. 9, pp. 297-303, figs. 9*).

The action of some bacterial and animal toxins on plants, M. CONSIGLIO (*Arch. Ital. Biol., 29 (1898), No. 3*).

Effects of lightning on grapevines, L. RAVAZ and A. BONNET (*Ann. École Nat. Agr. Montpellier, 10 (1898), pp. 221-236, pls. 3, figs. 6*).

FERMENTATION—BACTERIOLOGY.

Influence of oxygen on fermentation, G. KORFF (*Centbl. Bakt. u. Par., 2. Abt., 4 (1898), Nos. 11, pp. 465-472; 12, pp. 501-507; 13, pp. 529-535; 14, pp. 561-569; 15-16, pp. 616-627; abs. in Jour. Roy. Micros. Soc. [London], 1899, No. 2, p. 182*).—Pure cultures of Saaz, Frohberg, and Logos yeasts were studied under different conditions of nutrition to ascertain the influence of oxygen on fermentation, fermentation energy, and reproductive power. The nutritive solutions used were of cane sugar or yeast water, and asparagin. The following general conclusions were reached:

Moderate aeration favors the reproductive energy and power of Saaz and Frohberg, but lessens that of the Logos yeast. The fermentation energy may be raised by moderate aeration in the Saaz and Logos or lessened in the Frohberg, and the fermenting power of Frohberg and Logos is increased by the same means, while in the case of Saaz moderate aeration is without influence. Oxygen increases the reproductive energy and also the reproductive power of the different yeasts, but diminishes the fermentation energy and power in every case. Hydrogen or the total deprivation of oxygen inhibits the reproductive energy of Saaz and Logos, and is without influence on Frohberg yeast. It also causes a reduction of reproductive power, and either reduces the fermentation energy, as in Saaz and Frohberg, or is without influence. The fermenting power of Frohberg and Logos is increased in hydrogen, but it has no effect on Saaz yeast.

Preparation of bacterial culture solutions in large quantities, A. THEOKTISTOV (*Selsk. Khoz. i Lyesov., 188 (1898), Feb., pp. 315-325*).—Experiments were made during 1897, with a view of devising a method of sterilizing liquid nutritive media, whereby the essential drawbacks of the present method of sterilization should be obviated. The method adopted is based on the joint action of volatile chemical substances and a single heating to 100° C. Carbon disulphid, ether, and chloroform were selected as the most suitable volatile substances for introduction into the substratum to kill the micro-organisms and their spores without changing the nutritive media, or at least but slightly, and which could easily be removed by heating to a temperature not exceeding that of boiling water. The experiments were made with 0.5 per cent aqueous solution of Merck's peptone and pure cultures of *Bacillus mesentericus vulgatus* in bouillon. The fluids to be sterilized were placed in flasks in quantities of 500 to 1,000 cc., and 0.5 to 4 cc. of the volatile chemical added. The fluids were allowed to stand from 18 to 24 hours at room temperature, after which the flasks were heated to boiling, which was continued 5 to 20 minutes after the odor of the chemical disappeared. On cooling in thermostats to 28 or 29° the liquids proved to be perfectly sterilized. In order to ascertain whether the carbon disulphid, ether, or chloroform have affected the composition of the nutritive medium, cultures were made which developed normally in the usual time. Where chloroform was used the liquid retained its normal appearance, while ether and carbon disulphid caused the liquid to appear somewhat darkened or clouded, but did not affect the growth of the cultures. It was found that 0.5 cc. of carbon disulphid or ether were sufficient for sterilizing 1 liter. In the case of chloroform, not less than 1 cc. was required, but on account of the expense the experiments with this volatile agent were not so exhaustive as in the other cases. The experiments were repeated on a larger scale, tin flasks containing 15 liters of the liquid being used with equal success.—P. FIREMAN.

Influence of metals on bouillon cultures of bacteria, B. ISACHENKO (*Selsk. Khoz. i Lyesov., 189 (1898), Apr., pp. 35–42*).—The solution of two questions was sought: The influence of metals on the virulence of bacteria and on their growth and general activity. For the experiments *Bacillus spermophilinus* was used. The following are the conclusions of the author: In cases where the bouillon cultures must be kept in a metallic vessel for more than one month only vessels of iron, tinned iron (or tinned lead) are admissible, the purity of the tinning, i. e., freedom from lead, being immaterial. Nickel-plated, zinc, or zinc-plated iron vessels are absolutely unsuitable for growing and transporting bacteria. Copper apparatus and vessels can be used only for keeping the culture of the sterilized bouillon during a very brief time.—P. FIREMAN.

The alcohol-producing enzym of the yeast plant, J. R. GREEN (*Ann. Bot., 12 (1898), No. 48, pp. 491–498*).—In a previous paper (E. S. R., 9, p. 923), the author reports the inability to find the enzym described by Buchner in yeasts which were in a resting stage. In the present paper a report is given of continued investigations on this subject, from which it appears that yeast cells when active are able to secrete an enzym which can be extracted by means which are described. This enzym, when extracted, is capable of fermenting sugar solutions under conditions which prevent the activity of the living yeast. All the conditions of such fermentation are readily observed, such as the diminution of the sugar, production of carbon dioxid, and the formation of alcohol. The enzym is easily decomposed, and is only secreted by the cell during actual fermentation by the yeast. It is quickly decomposed when this activity ceases, so that the resting yeast does not yield it. The high pressures which were employed by Buchner were found to be unnecessary for the extraction of the enzym, the author finding low pressures of 5 atmospheres to the square inch more active than those obtained by the use of hydraulic pressure.

The proteolytic enzym of Nepenthes, S. H. VINES (*Ann. Bot., 12 (1898), No. 48, pp. 545–555*).—In a previous paper (E. S. R., 9, p. 813), the author has called attention to the presence of an enzym in the pitchers of Nepenthes. He has followed up his investigations on this subject and states that the action of high temperatures and alkalis upon the enzym confirmed the statement made in the previous paper regarding its great stability. While the activity of the enzym may be diminished by exposure to high temperatures, or treatment with alkalies, it retains a sort of digesting power which can only be destroyed by relatively strong measures. It seems probable that the enzym is derived from a zymogen present in the gland cells. The presence of a true peptone among the products of digestion seems to indicate that it is a tryptic ferment mainly differing from trypsin of the pancreatic juice in requiring an acid medium for its digestive action.

Cellulose enzyms, F. C. NEWCOMBE (*Ann. Bot., 13 (1899), No. 49, pp. 49–81*).—The author reports a number of experiments conducted with extracts made from barley malt; *Aspergillus oryzæ*; cotyledons of *Phœnix dactylifera*, *Lupinus albus*, peas, and buckwheat; and the endosperm of *P. dactylifera*. The method of extracting these different enzyms is given, and their reaction upon starch and the cell walls is described. The author briefly summarizes the results of his work as follows:

"The enzym extracted from *A. oryzæ* attacks reserve cellulose with greater intensity than it attacks starch.

"The enzym from the cotyledons of seedlings of *L. albus* is very strongly cytohydrolytic but very feebly amylohydrolytic.

"The enzym from the cotyledons of seedlings of *P. dactylifera* is very strongly cytohydrolytic and very feebly amylohydrolytic, attacking starch a little more strongly than the extract of Lupinus does.

"The enzym from the endosperm of *P. dactylifera* is very strongly cytohydrolytic but amylohydrolytic to a little less degree than the extract of Lupinus and to a considerably less degree than the enzym from the cotyledons of Phœnix.

"The very dilute enzym of the malt of *Hordeum vulgare* as well as that of the other plants here considered attacks reserve cellulose; hence an enzym-solution need not be strong to act on cell walls.

"None of the 5 enzym extracts used in this work shows itself more than the other extracts peculiarly suited to the solution of any one kind of reserve cellulose here employed.

"With all the ferments the walls at first become hyaline, appear gradually more and more transparent, and finally melt wholly away in solution.

"The enzyms from *L. albus* and from *P. dactylifera* act on starch so feebly and on reserve cellulose so energetically that they are to be regarded as cytase as distinguished from diastase."

Investigations on the biochemic production of sorbose, G. BERTRAND (*Ann. Inst. Pasteur, 12 (1898), No. 6, pp. 385–399*).—The author concludes from his investigations that sorbose, the sugar which was discovered by Pelouze in 1852 under the name "sorbine," does not exist in the juice of the fruit of *Sorbus aucuparia* and allied species. On the other hand, it appears that it is produced by the oxidation of sorbite under the influence of bacteria analogous to or identical with *Bacterium xylinum*. In making cultures of these bacteria in a medium containing sorbite the transformation of sorbite into sorbose is easily effected, and in many cases as much as 80 per cent of the theoretical amount is obtained.

The principles of bacteriology, F. Heuppe, translated by E. O. Jordan (*London: Kegan Paul, Treubner, Trench & Co., 1899*).

Bacteria and yeasts in agricultural practice, M. Hoffmann (*Bakterien und Hefen in der Praxis des Landwirthschaftsbetriebes. Berlin: Paul Parey, 1899, pp. 118, figs. 19; rev. in Centbl. Bakt. u. Par., 2. Abt., 5 (1899), No. 7, pp. 224, 225*).—According to the review the author, who has been at different times connected with the experiment stations of Tharand, Halle, Köslin, etc., has prepared a very practical work treating of the life history of these organisms and describes their action. Among those described are soil bacteria, bacteria of stable manure, of nitrogen assimilation, of wine and similar fermentations, of milk, silage, bread, sauerkraut, and of numerous infectious diseases of animals In the latter connection the use of various lymphs and cultures is explained at some length.

Fermentation and germ life, J. Nelson (*New Jersey Stas. Bul. 134, pp. 24, pls. 2*).—The general nature of ferments and fermentation is given, with descriptions of the various organisms which cause these changes. The distribution of the organisms is commented upon, and various methods suggested for the control of fermentation. In the plates, microscopic reproductions are given of a number of forms of bacteria and other vegetable organisms which are concerned more or less with the subject in hand.

Plain talks on bacteria as applied to farm problems, H. L. Russell (*Hoard's Dairyman, 30 (1899), No. 16, p. 312*).—A popular article treating of bacterial diseases of plants.

The phylogeny and polymorphism of bacteria, V. Gurgi (*Sur la phylogenie et le polymorphisme des bactéries. Montevideo, 1898, pp. 88*).

On the effect of laboratory air on the growing of nitrobacteria, W. Rullmann (*Centbl. Bakt. u. Par., 2. Abt., 5 (1899), No. 7, pp. 212-216*).

The action of "sorbose bacteria" on aldehydes, G. Bertrand (*Bul. Mus. Hist. Nat. [Paris], 1898, Nos. 6, pp. 293-295; 7, pp. 330-332*).

The influence of various forms of nitrogen on yeasts, Lange (*Wchnschr. Brau., 16 (1899), No. 5; abs. in Bot. Centbl., 78 (1899), No. 9, pp. 272, 273*).

On the physiology and morphology of alcoholic ferments, E. C. Hansen (*Ann. Microg., 1898, No. 10, pp. 305-322*).—Treats of the vitality of alcoholic ferments, and their variation in different media and when in a dry state.

Olive fermentation, L. Navarro (*Memoria relativa a las enfermedades del olivo. Madrid: Raoul Peant, 1898, pp. 153*).

Recent observations on the development of aromatic principles by alcoholic fermentation in the presence of certain leaves, G. Jacquemin (*Compt. Rend. Acad. Sci. Paris, 128 (1899), No. 6, pp. 369-371*).

Action of formaldehyde on enzyms and on certain proteids, C. L. Bliss and F. G. Novy (*Jour. Expt. Med., 4 (1899), No. 1, pp. 47-80*).

On the distribution of enzyms in seeds with special reference to the enzyms of glycerids, C. Lumia (*Staz. Sper. Agr. Ital., 31 (1898), No. 4, pp. 397-416*).

Conversion of mold fungi into alcohol yeasts, A. Jörgensen (*Centbl. Bakt. u. Par., 2. Abt., 4 (1898), p. 860; abs. in Jour. Roy. Micros. Soc. [London], 1899, No. 1, pp. 65, 66*).—In a preliminary communication on the genetic relation between alcohol yeasts and molds, the author states that the experimental proof of the conversion of a Dematium into an alcohol yeast fungus and its reconversion into a mold has been attained. The conditions under which this conversion takes place are to appear in a subsequent publication, as will also the conditions in which endogenous spores appear in the mold having all the characteristics of *Dematium pullulans*.

Concerning the work of various antiseptics on wine micro-organisms, W. SEIFERT (*Sonderabdr. Oesterr. Chem. Ztg., 1 (1898), No. 13-14, pp. 20*).

Investigations concerning wine yeasts and the use of pure cultures in wine making, V. PEGLION (*Staz. Sper. Agr. Ital., 31 (1898), No. 1-2, pp. 81-110*).

Report on experiments with pure cultures of wine yeast in 1897, A. NASTUKOV (*St. Petersburg: Ministry of Agriculture and Imperial Domains, 1898, pp. 19; rev. in Selsk. Khoz. i Lyesov., 192 (1899), Jan., p. 226*).

Contributions to the study of wine fermentation, V. PEGLION (*Staz. Sper. Agr. Ital., 31 (1898), No. 3, pp. 222-234*).

The mannitic fermentation of wine, W. SEIFERT (*Seperat. Allg. Wein Ztg., 1898, pp. 8*).

On the pasteurization of wine, U. GAYON (*Prog. Agr. et Vit. (Ed. L'Est), 20 (1899), No. 14, pp. 430-435*).

METEOROLOGY—CLIMATOLOGY.

Proceedings of the Convention of Weather Bureau Officials, held at Omaha, Nebraska, October 13-14, 1898 (*U. S. Dept. Agr., Weather Bureau Bul. 24, pp. 181, pl. 1*).—Sixty-four officials of the Weather Bureau and 16 voluntary observers of the climate and crop sections were present at this convention. The topics discussed included the following: Relation between the Weather Bureau and the public, by F. J. Walz and G. N. Salisbury; Forecasts best calculated to aid maritime interests of the Great Lakes, method of reaching those interested, by H. J. Cox and N. B. Conger; Are the present warnings and displays by flag and lantern the best that can be devised for the Atlantic and Gulf coasts? by J. W. Smith and A. G. McAdie; Possibility of giving warnings of northers, cold waves, and heavy snows to stock-raising interests forty-eight hours in advance, by F. H. Brandenburg and E. J. Glass; Warnings of washouts, floods, cold waves, and heavy snowfalls for the benefit of transportation companies, by J. W. Smith and T. S. Outram; What classes are most benefited by the forecasts? Are they just what are needed? Are they properly disseminated and utilized? by J. R. Sage and H. C. Bate; Long range forecasts: Can they be made with sufficient precision to be of general utility? by H. A. Hazen, P. Connor, and B. S. Pague; Forecast distribution: Should the wording of the forecasts be confined to the vocabulary of the present logotype outfit? Is it advisable to extend the vocabulary of the logotype outfit? by F. P. Chaffee and G. M. Chappel; River and flood service, by R. J. Hyatt and L. M. Pindell; Should warning messages (Form 1043 C) be of some distinctive color to more readily attract attention? by S. W. Glenn and T. B. Jennings; Relation of the Weather Bureau to the Department of Agriculture, by E. B. Calvert; West Indian hurricane service, by W. L. Moore; Possibilities of the weather service on the Pacific Coast: Value of Mount Tamalpais observations, by W. H. Hammon and B. S. Pague; Some rain-producing processes, by E. B. Garriott; Relations with the press, commercial bodies, and scientific organizations—how promoted, by E. A. Beals and A. F. Sims; Meteorological statistics: How to improve them that they may meet the needs of the medical profession, hydraulic and sanitary engineers, promoters of irrigation projects, etc., and does the present monthly section report meet such needs? by E. W. McGann and W. M. Wilson; Some notes on agricultural meteorology, with special reference to the rainfall element, by C. E. Linney; Effect of forest clearing and cultivation upon (1) water supply and soil, (2) rainfall, (3) temperature, by W. M. Fulton and G. N. Salisbury; Is the weather map appreciated and understood by the masses? Would not the postal-card weather forecast prove a satisfactory substitute for the map, except where it is used for the purposes of study and instruction? by E. B. Calvert and T. F. Townsend; Primary work on meteorology for the use of schools, by P. Connor; Should not certain important Weather Bureau stations, the duties of which cover a wide range of work, be designated stations of instruction for newly appointed observers? by J. W. Smith and C. F. R. Wappenhaus; Climate and crop service weekly bulletins: Should remarks of correspondents be published as supplementary to general discussion? Should weekly reports of temperature and rainfall be telegraphed to section centers from selected voluntary stations? by A. E. Hackett and J. B. Marbury; Frost fighting, by A. G. McAdie; Aerial observations, by G. B. Wurtz, G. H. Noyes, and J. C. Piercy; Should not a book providing for a permanent record of meteorological observations for a prolonged period be furnished to the section centers for their use and for voluntary stations? by G. A. Loveland and J. W. Bauer; Atmospheric moisture and artificial heating, by W. M. Wilson; Should not a book be provided suitable for keeping record of the issue of instruments and flags to voluntary observers? by R. G. Allen and B. H. Bronson; Are changes in the present forms (1053 and 1054) for reporting weekly climate and crop conditions advisable? by C. E. Linney and A. J. Mitchell; Should compensation be allowed persons not in the employ of the Bureau while learning station duties to enable them to properly perform such duties in cases of emergency? by D. Cuthbertson and G. E. Franklin; Professor Marvin's weighing rain and snow gauge, by W. W. Carlisle; Interchange of standard climatic data, by A. G. McAdie; Studies of climate, by F. J. Walz; Voluntary stations: Their object and collateral functions, by A. J. Mitchell; Snow and ice measurements, by H. Volker; Benefits of the Weather Bureau to western Nebraska, by J. C. Piercy; Development of the daily weather map, by E. B. Calvert; Establishment and inspection of voluntary, river, and cotton-belt stations, by J. B. Marbury; Storm signals on the Great Lakes, by J. H. Cox; Can long-range weather forecasts be made with any degree of accuracy or profit? by A. B. Crane; The weather as a topic of conversation, by A. S. Brendle; Distribution of forecasts by mail, by P. F. Lyons; Utility of hygrometric observations, by A. Pennell and H. A. Hazen; Wind vanes, by C. P. Cronk; Forecasts of probable temperatures, by I. M. Cline; An official of the Weather Bureau: His duties and qualifications, by B. S. Pague.

The climate of the Congo (*Nature, 59 (1899), No. 1537, p. 564*).—This is a brief note on a work by A. Lancaster and E. Meuleman entitled *Le climat du Congo*, published in 1898. The temperature of this region is very uniform throughout the year, being as a rule about 86° F. in the afterntoon and 68° at night. The distinctive feature of the climate is the rainfall. The rainy season commences early in October and ends about the middle of May. The division into wet and dry seasons becomes less clearly defined as the distance from the sea increases and from the equator decreases. The rainfall is nowhere exceptional. Thunderstorms occur frequently in the interior—at all seasons in the equatorial region, only during the rainy season in the south and west.

On the photochemical climate of the Arctic regions, WIESNER (*Bot. Centbl., 75 (1898), No. 8, pp. 233-235*).—A brief résumé is given of a paper by the author, in which the results of his investigations on the climate of high latitudes are stated. It is claimed that at Tromso and Advent Bay the intensity of light is greater than at Vienna or Cairo for the same elevation of the sun and equally cloudy skies. At Advent Bay there was found little difference between the intensity of the light in the forenoon and afternoon. Usually the intensity of light in the afternoon has been found the greatest. During August the intensity of the light was 2.5 times that at Vienna when the sun was at the same elevation, namely, from November to February. The bearing this has upon plant growth is to be given in a subsequent paper.

Meteorological observations, J. E. OSTRANDER and A. C. MONAHAN (*Massachusetts Hatch Sta. Met. Buls. 121, 122, 123, pp. 4 each*).—The usual summaries of observations, with general notes on the weather during January, February, and March, 1899. The precipitation during February and March was considerably above the normal.

Meteorology, C. H. PETTEE (*New Hampshire Sta. Bul. 59, pp. 216-219*).—General notes on the weather and a monthly and annual summary (July, 1896-June, 1898) of observations on temperature, precipitation, cloudiness, and prevailing winds. The mean temperature for the year 1897-98 was 45.9° F., the precipitation 44.8 in. The year was characterized by a large but uniformly distributed precipitation.

Meteorological data and bloom notes, W. B. ALWOOD and H. L. PRICE (*Virginia Sta. Bul. 82, pp. 117-127, charts 2*).—This is a summary of observations made at the station since 1893 and comprises tabulated data for temperature, pressure, precipitation, cloudiness, and direction of the wind for each month, 1893-1898, and a record for the same years of the bloom periods of 2 varieties of pears, 3 of plums, 2 of cherries, and 1 each of apples, raspberries, blackberries, currants, and dwarf juneberries. The monthly precipitation and the maxima, minima, and mean temperatures are charted.

Meteorological summary for Laon, France, for the year ending November 30, 1898, L. GAILLOT (*Bul. Sta. Agron. Aisne, 1898, pp. 7-19*).

Observations on rainfall and temperature in the Department of Gironde, France, June, 1897, to May, 1898, G. FAYET (*Append. to Mem. Soc. Sci. Phys. et Nat. Bordeaux, 5. ser., vol. 4*).—The observations are tabulated and discussed in detail.

Observed variations in the velocity of the wind, F. HOUDAILLE and DESMOULINS (*Ann. École Nat. Agr. Montpellier, 10 (1897-98), pp. 48-56, pls. 2, fig. 1*).—Data for variations in velocity during the year are given and the amount of the force of the wind utilized by windmills is discussed. The work of the mill and pump used, measured by water raised, was 31,380,000 km. per 1 square meter of mill surface during an annual period of 31,536,000 seconds, the pump utilizing 0.7 of the force of the mill.

Researches on the movement of the winds of the southern Cévennes to the Mediterranean, F. Houdaille (*Ann. École Nat. Agr. Montpellier, 10 (1897–98), pp. 5–47, figs. 10*).

Climate and crop report, season of 1898, Alaska section, H. L. Ball (*U. S. Dept. Agr., Weather Bureau Doc. 188, pp. 7*).—Reprinted from Monthly Weather Review, 26 (1898), No. 12 (E. S. R., 10, p. 1018).

Frost: When to expect it and how to lessen the injury therefrom, W. H. Hammon (*U. S. Dept. Agr., Weather Bureau Bul. 23, pp. 37*).—This is a revised reprint of an earlier bulletin on this subject (E. S. R., 8, p. 109).

International cloud studies, 1896–97. Observations in Sweden (*Études internationales des nuages, 1896–97. Observations et mesures de la Suède. Upsala: Akad. Bokh., 2 v., pp. 29+103, pl. 1*).

On the blue color of the sky and sea, R. Abegg (*Naturw. Rundschau, 14 (1899), No. 13, pp. 157, 158*).

On the cause of the blue color of the sky, W. Spring (*Bul. Acad. Roy. Sci. Belg., 3. ser., 36 (1898), p. 504; abs. in Naturw. Rundschau, 14 (1899), No. 15, p. 189*).

An elementary treatise on practical and agricultural meteorology (*Traité élémentaire de météorologie pratique et agricole, suivi de notions cosmographie. Chambéry: Perrin, pp. 64, figs. 5*).

AIR—WATER—SOILS.

Moisture of soil in relation to the crops under cultivation and to the climatic conditions, T. Lokot (*Selsk. Khoz. i Lyesov., 191 (1898), Nov., pp. 305–347; Dec., pp. 517–582*).—This article is based upon data obtained in the Poltava Experiment Field during the last 3 or 4 years, almost 2,000 determinations of moisture being made annually. In view of the fact that in order to judge of the adequacy of the moisture of a soil as determined by analysis it is necessary to know the minimum of moisture which will supply the demand of plants for transpiration, the author tried to establish this minimum for the soil of the Poltava Experiment Field. This he assumes (for the present) to be double the maximum hygroscopicity of the soil, which was found to be 5 per cent.

During the 3 years, 1895–1897, the moisture was determined on the most important plats of the field under the following conditions: On fallow land which had been uncultivated for many years, on plats occupied by perennial grasses, on alfalfa fields in 5-course and 10-course rotations, on plats under maize as compared with plats under cereals and broad-leaved plants, on fallow fields, and on fields under winter and spring cereals. A record of meteorological conditions was kept at the same time. Samples for the estimation of moisture were taken at the following depths: 0 to 5.25, 5.25 to 10.5, 10.5 to 15.75, 15.75 to 21, 21 to 28, 28 to 35, 35 to 42, 42 to 49, 49 to 56, 56 to 63, and 63 to 70 in.

Determinations were made for every plat from 3 to 5 times during the growing period. The mean results were found to vary as follows:

Moisture content of soils under different conditions.

	Per cent.
On fallow land, in the steppe	13.01
In the forest	13.62
On plowed plats	16.04
On plats covered with sod	13.85
Under gramineous plants	12.69
Under papilionaceous plants	12.33
In 5 course rotation:	
Alfalfa, plowing 7 in. deep	14.32
Alfalfa, plowing 14 in. deep	14.36
Corn, plowing 7 in. deep	15.75
Corn, plowing 14 in. deep	15.53
Corn, fertilized plats	15.83
Corn unfertilized plats	15.31
Alfalfa, plowing 14 in. deep	13.68
Alfalfa plowing 7 in. deep	13.63
Alfalfa fertilized plats	13.05
Alfalfa unfertilized plats	12.85
In 10-course rotation:	
Alfalfa	12.70
Fallow	15.50
Spring wheat	13.63
Winter wheat	13.76
Beets	14.73
In 8-course rotation:	
Spring wheat	14.52
Beets	14.27
In 8-course rotation—Continued.	
Corn	15.64
Buckwheat	14.28
In old 3-course rotation:	
Spring crop fields	14.37
Winter crop fields	14.40
Fallow crop fields	16.40
Black fallow, plowing 10.5 in	17.51
Black fallow, plowing 5.25 in	17.76
Green fallow, unfertilized, plowing 10.5 in	17.00
Green fallow, unfertilized, plowing 5.25 in	16.33
Winter crop field, under rye	15.21
Winter crop field, under wheat	16.31
Winter crop field, fertilized fallow	15.47
Winter crop field, unfertilized fallow	15.11
Winter crop field, black fallow	16.70
Spring crop field, under wheat	16.28
Spring crop field, under oats	16.18
First 3-course rotation:	
Black fallow	16.81
Early fallow	16.82
Middle fallow	15.99
Late fallow	15.17

—P. FIREMAN.

Second report on the work in studying the fertility of soils, S. BOGDANOV (*Selsk. Khoz. i Lyesov., 191 (1898), Nov., pp. 387–414; Dec., pp. 499–516*).—In an earlier article the author described investigations regarding the fertility of soils carried out by him and his associates in the agricultural laboratory of the Kiev University, the principal conclusions from which were that it is possible to determine, by chemical analysis, the amounts of nitrogen and phosphoric acid assimilable by oats in a soil. The assimilable nitrogen was determined as follows: The soil, containing about 50 per cent of the available moisture which it was capable of holding, was kept for 48 hours in a thermostat at 30° C., and the nitrogen as ammonia (and in related forms) and as nitric acid was determined. Seventy-five per cent of this nitrogen was assumed to be assimilable by oats in the following vegetation period under favorable circumstances. For the determination of the phosphoric acid assimilable by oats the soil was digested with a 2 per cent acetic acid solution in the ratio of 1 part of the soil to 4 parts of the acid during 24 hours, and all the phosphoric acid extracted was assumed to be assimilable by oats in the vegetation period immediately following.

These methods were based on experiments carried out prior to 1896 with a number of soils on which oats were cultivated with and without fertilizers. In 1896 and 1897 the conclusions were confirmed by the results of a series of experiments on other soils. The tests were made in zinc pots, according to Wagner's method, though with some modifications.

With a view to testing the applicability of the results obtained by this method with one crop to others, experiments were made with barley, millet, peas, and white mustard on the same soils on which oats had been cultivated before. It was found that as regards nitrogen and phosphoric acid the results with oats gave correct indications of the requirements of other plants. The author is inclined to think that with a given soil fertility, various plants develop differently in correspondence with the peculiarities of their morphological and anatomical structure, chemical composition, etc., but not because they do not avail themselves in the same way of the fertility of the soil.

Further experiments which extended over 2 or 3 years showed that a laboratory investigation of the fertility of the soil furnished a basis for sound conclusions as to the yields for 2 to 3 years following.

For determining the available constituents of the soil the author recommends, as a result of his investigations, the use of an aqueous extract obtained by shaking 1 part of soil with 100 parts of water. Such an extract contains at least as much phosphoric acid in solution as is dissolved by a 2 per cent acetic acid solution (soil and acid in the ratio of 1:4) and also potash and lime, and apparently the other constituents, in sufficient quantities. The aqueous extracts were prepared by shaking the soil with water for 48 hours, and then filtering with suction through funnels closed with porous clay plates. A perfectly clear solution was thus obtained.—P. FIREMAN.

A rapid method for the determination of the amount of soluble mineral matter in a soil, T. H. MEANS (*Amer. Jour. Sci., 4. ser., 7 (1899), No. 40, pp. 261–266*).—This method, which has been worked out in the Division of Soils of this Department, "is practically a means of determining the specific electrical conductivity (or resistance) of the solution between the soil grains. When this is known, the amount of any salt which will produce this same conductivity may be calculated from published tables of the conductivity of salt solutions." The apparatus required and the method followed have already been described in bulletins of the Division of Soils (E. S. R., 9, p. 535; 10, p. 30). Directions for making salt determinations in soils are given in this article.

The method has been found to offer special advantages for the study of irrigated districts and alkali soils[1] since the apparatus necessary can readily be carried in the field and 2 men can examine from 60 to 100 samples of soil in a day.

Action of very dilute acid solutions on the phosphates of the soil, T. H. SCHLOESING, Jr. (*Compt. Rend. Acad. Sci. Paris, 128 (1899), No. 16, pp. 1004–1007; abs. in Jour. Chem. Soc. [London], 76 (1899), No. 440, II, p. 449*).—In the author's experiments 10 to 20 gm. of 4 different soils were treated with 1 liter of water unacidulated or containing from 0 to over 20,000 mg. of nitric acid (N_2O_5). After rotation in a horizontal position for 10 hours, the acidity and phosphoric acid and iron contents of the solutions were determined. It was found that up to a certain point (100 to 200 mg. per liter) the amount of phosphoric acid dissolved varied with the concentration of the acid. Beyond this a further addition of acid did not decidedly increase the amount of phosphoric acid dissolved until the acid became quite concentrated (1 gm. per liter). The phosphates of calcium, magnesium, and the alkalis were dissolved out during the first stage, the extract containing only traces of iron. When the second stage was entered, however, the iron began to be freely dissolved. The soils which yielded the most phosphoric acid to the dilute acid (100 to 200 mg. N_2O_5 per liter) were those whose phosphoric acid proved most soluble in water.

---

[1] U. S. Dept. Agr., Division of Soils Bul. 14 (E. S. R., 10, p. 1026).

The daily heat exchange in the soil and the radiation of heat between the earth and the atmosphere, T. HOMÉN (*Der tägliche Wärmeumsatz in Boden und die Wärmestrahlung zwischen Himmel und Erde. Leipsic: Wilhelm Engelmann, 1897, pp. 147; noted in Phys. Rev., 8 (1899), No. 4, p. 251*).—This volume presents the results of researches at the University of Helsingfors upon solar radiation and the daily interchange of heat between the earth and the atmosphere.

The experiments, which ran through several summers, "included daily measurements and, for periods of many days, hourly measurements of the temperature of the upper layers of the earth's crust. Readings were taken at 10 different depths beneath the surface, varying from 1 to 70 cm., in sandy soil, in clay soil, beneath the vegetation of moorland and meadows, in granite rock, and in the waters of a small lake. Corresponding measurements were taken in the air at heights above the surface running to 10 meters. Determinations of the formation of dew with estimates of the amount of heat thus set free were likewise carried on, and measurements were made of the direct radiation from the sun, of that from the open heavens, and of the return radiation from the earth's surface." A special form of thermometer was used for the measurements of soil temperatures. For the measurements of radiation a modification of Ångstrom's instrument[1] was employed. The temperature readings are plotted on a large scale.

Contribution to the study of the forms and conditions under which the chlorin of the soil ordinarily enters plants, P. PICHARD (*Compt. Rend. Acad. Sci. Paris, 128 (1899), No. 10, pp. 615-617; abs. in Rev. Sci., 4. ser., 11 (1899), No. 11, pp. 340*).—The investigations here recorded were undertaken to determine the forms and conditions under which the chlorin of the soil enters into growing tobacco. Five series of pot experiments were made with 2 varieties of tobacco on (1) sand charged with chlorids (0.5 to 2 gm. per kg.) receiving (a) organic fertilizers (b) nitrates; (2) artificial soils poor in potash and chlorin, fertilized as in (1); (3) artificial soils rich in potash, poor in chlorin, fertilized as in (1); (4) natural soils well supplied with potash and organic nitrogen, poor in chlorin, fertilized with nitrates; (5) same as (4) except kept in diffused light, the first 4 series of experiments being conducted in sunlight. Samples of tobacco grown under these conditions, as well as by planters on various kinds of soil containing from 0.28 to 0.7 gm. of chlorin per kilogram, were subjected to chemical analysis.

---

[1] See Phys. Rev., vol. 1, p. 365.

It was found that the chlorin content of the tobacco increased with the amount in the soil. Only the chlorids of potassium and sodium were found in appreciable amounts in the tobacco, the chlorid of potassium largely predominating. The amount of chlorin in the tobacco increased with the amount of potash in the soil. There was found as high as 11.23 per cent of potassium chlorid in the leaves of tobacco, the proportion in the stems being less and in the roots still smaller. On soils rich in chlorids tobacco appears to store up potassium chlorid in large quantities. Chlorid of sodium is taken up less readily by tobacco. In fact, it is not likely to appear in the plant unless it is present in the soil in large amounts. The most careful examination of the tobacco failed to detect the presence of any salt of sodium except the chlorid. The author suggests that in contact with the roots the potash replaces sodium in combination with chlorin, the potassium chlorid being taken up by the plant while the salts of sodium remain in the soil. It was observed in these investigations that a decrease in the amount of the nitrates of the soil was accompanied by an increase of the chlorin in the tobacco, and *vice versa.*

Is iodin present in the air? A. GAUTIER (*Compt. Rend. Acad. Sci. Paris, 128 (1899), No. 11, pp. 643–649*).—Examinations of the air of Paris, of woodland, high mountains, and of the sea led to the conclusion that iodin derived from the decomposition of alkaline iodids is not present in the air in appreciable quantities. There was a certain amount of iodin present, especially in sea air, in the form of suspended organic matter.

Microscopy of drinking water, G. C. WHIPPLE (*New York: John Wiley & Sons, 1899, 1. ed., pp. 300, ill.*).

Microscopic water analysis, C. MEZ (*Mikroskopische Wassersanalyse. Berlin: Julius Springer, 1898.*

On the influence of electricity on the oxygen content of water, O. BERG and K. KNAUTHE (*Naturw. Rundschau, 13 (1899), Nos. 51, pp. 661–664; 52, pp. 675–677*).—Under the influence of electricity the oxygen consumption in water is accelerated. This is shown in the increased activity of electrolytic processes, such as the fixing of the nitrogen of the air.

On the industrial sterilization of potable waters by means of ozone, MARMIER and ABRAHAM (*Compt. Rend. Acad. Sci. Paris, 128 (1899), No. 17, pp. 1034, 1035; Rev. Sci. [Paris], 4. ser., 11 (1899), No. 20, pp. 625–627*).

Some Nevada soils, N. E. WILSON (*Nevada Sta. Bul. 39, pp. 30*).—"This bulletin is intended as a forerunner of a more exhaustive work on the soils and irrigation waters of the State of Nevada. A general survey of the State, for this purpose, is under consideration and it is hoped it can be carried out in the near future." Chemical analysis of 26 samples of typical soils collected in different parts of the State are reported, and the origin, classification, and composition of soils in general are discussed.

Alkali lands, M. WHITNEY and T. H. MEANS (*U. S. Dept. Agr., Farmers' Bul. 88, pp. 23, fig. 1*).—This is essentially a summary of Bulletin 14 of the Division of Soils (E. S. R., 10, p. 1026), discussing conditions in the Yellowstone Valley, rainfall and seepage, how salt determinations are made, kinds of soils in the valley, salt content of the soils, and effect of underdrainage in removing the salts.

The soil, E. HOTTER (*Bodenkunde. Graz: Landes-Versuchsstation, 1899, pp. 56*).—An elementary treatise on the origin, formation, and properties of soils.

On soil management, A. ANSTADT (*Fühling's Landw. Ztg., 48 (1899), No. 8, pp. 297–300*).—This is a general discussion of the exhaustion of soils under different rotations. The general conclusion is reached that a record of the income and outgo of the fertility of the soil is not always a reliable guide in practice, since in many cases it is necessary to return more of the fertilizing constituents than the crops grown remove, in order to maintain and increase the productive capacity of the soil.

On the loss of plant food in cultivated soils E. WOLLNY (*Deut. Landw. Presse, 26 (1899), Nos. 34, p. 383; 36, p. 412; 37, pp. 424, 425*).

Contribution to the chemical study of the alluvial soils of Lodi, G. FASCETTI and F. GHIGI (*Staz. Sper. Agr. Ital., 32 (1899), No. 1, pp. 131–136*).

Minutes of the forty-first meeting of the Central Moor Commission, December 12–14, 1898 (*Protokoll der 41 Sitzung der Central-Moor-Commission. Berlin, 1899, pp. IV+216+38+8+31, pls. 10*).—Most of the experimental work referred to in this report has already been noted (E. S. R., 10, pp. 931, 1022).

The moor soils of Westphalia, G. HASELHOFF and H. BREME (*Die Haideböden Westfalens. Berlin, 1899, pp. 31, dgms. 3*).—This is the first part of this treatise and is devoted to the moors of Dörmen. It discusses the general properties, the mechanical and chemical composition, and the reclamation of these soils. A topographical map gives the location of the soils, and diagrams show the physical characteristics of the soils.

FERTILIZERS.

The action of organic nitrogen, particularly of barnyard manure, as a fertilizer, T. PFEIFFER, E. FRANKE, O. LEMMERMANN, and H. SCHILLBACH (*Landw. Vers. Stat., 51 (1899), No. 1–5, pp. 219–310*).—The work of other investigators, especially that of Maercker and Wagner, is reviewed at some length, and pot and field experiments by the authors during 3 years (1895–1897) are reported.

The soil used in both the pot and the field experiments was sandy and poor in nitrogen. In the pot experiments the crops grown were oats and mustard in 1895, carrots in 1896, and oats again in 1897; the fertilizers tested were nitrate of soda, sulphate of ammonia, ground horn, dried blood, meat and bone fertilizer, and barnyard manure without preservative and preserved with sulphuric acid and calcium carbonate. In the field experiments the rotation was potatoes, winter rye, mustard, and carrots; the fertilizers tested were nitrate of soda and barnyard manure. Fertilizers were not applied after the first year.

Ground horn, dried blood, and barnyard manure showed a higher fertilizing value in the pot experiments than was obtained by Wagner in similar experiments, as the following table shows:

Fertilizing value of different forms of organic nitrogen.

Fertilizer.	Effectiveness, taking nitrate of soda as 100.	
	In these experiments.	In Wagner's experiments.
	Per cent.	*Per cent.*
Ground horn	83–84	63
Dried blood	85	69
Barnyard manure withou preservative	46	
Barnyard manure preserved with sulphuric acid	56 }49	32
Barnyard manure preserved with calcium carbonate	45	

The after effect of the fertilizers was found to be considerable and was taken into account in estimating the fertilizing value of the different materials. The unpreserved manure, which showed an effectiveness of 46 per cent in the pot experiments, was found to have a fertilizing value of 92 to 93 per cent in the field experiments. This difference is believed to be due to the better aeration in the field than in the pots.

The after effects of the manures were not noticeable in the field after the second year.

Since in the field experiments the nitrogen of the manure was almost as effective as that of the nitrate of soda, even when applied at the rate of about 27 tons per acre, denitrification could not have gone on there to any marked extent. The poorer results in the pots may have been due to increased denitrification in the less thoroughly aerated soil.

Experiments on the treatment of manure with acid superphosphates, E. MARRE and L. BOYER (*Prog. Agr. et Vit. (Ed. L'Est), 20 (1899), No. 14, pp. 411–415*).—In these experiments the manure from 2 cows (from January 18 to March 8) was treated, morning and night, with 1 kg. of 14 to 16 per cent superphosphate, and that from 2 other cows with 1 kg. of the same superphosphate to which was added 100 gm. of sulphuric acid (53° Baumé). The manure received otherwise identical treatment, remaining in heaps until April 19. The two lots were then applied at the rate of 56,000 kg. per hectare to parallel plats of soil very rich in phosphoric acid and potash, on which potatoes were grown. The yield was decidedly less on the plat to which manure treated with acidulated superphosphate had been applied than on that receiving nonacidulated manure.

The manurial value of Nile mud, W. C. MACKENZIE (*Jour. Khed. Agr. Soc. and School Agr., 1 (1899), No. 3, pp. 99–101, figs. 2*).—"In Upper Egypt, where the basin system of irrigation is employed, the land receives yearly a deposit of Nile mud, which enriches the soil." From the amount and chemical composition of the sediment carried by the Nile water at different seasons the fertilizing value of this mud is computed. A comparison of the fertilizing matter supplied by the irrigating water with the fertilizer requirements of different crops indicates that—

> "Nile mud does not supply a sufficient amount of nitrogen for the use of 'nitrogen consuming' crops, but the growth of berseem [leguminous plants] may, in part at least, supply this deficiency.
>
> "Nile mud supplies sufficient quantities of phosphoric acid and potash for the growth of fair crops of cotton, wheat, barley, maize, beans, and potatoes, but does not do so for sugar cane, berseem, and berseem hagazi [alfalfa], though if the two latter crops are consumed by cattle on the land they may be left out of consideration."

Liming, C. W. BURKETT (*New Hampshire Sta. Bul. 59, pp. 178–182*).—Lime (1 ton per acre) was applied to an old meadow in connection with commercial fertilizers. The increase due to the liming is shown in the following table:

Increase in yield of hay due to liming, 1897–98.

	1897.	1898.	Average.
	Pounds.	*Pounds.*	*Pounds.*
Kainit and acid phosphate with lime	4,520	1,760	3,140
Kainit and acid phosphate without lime	3,480	1,600	2,540
Increase due to lime	1,040	160	600
Muriate of potash and acid phosphate with lime	4,440	2,080	3,260
Muriate of potash and acid phosphate without lime	3,360	1,440	2,400
Increase due to lime	1,080	640	860
Muriate of potash, acid phosphate, and nitrate of soda, with lime	4,280	2,520	3,400
Muriate of potash, acid phosphate, and nitrate of soda, without lime	3,800	2,520	3,160
Increase due to lime	480	....	240

"From these results it is evident that the lime has been more effective in the first season's growth."

In an experiment of the same kind on corn for silage the increase due to liming was 4,640 lbs. per acre, the total yield with lime being 16,820 lbs. per acre.

Tests by Wheeler's method (E. S. R., 9, p. 640) of the reaction of the soil of the different fields of the college farm are reported. Most of the soils were found to be acid.

Thomas slag vs. redondite as a fertilizer, C. W. BURKETT (*New Hampshire Sta. Bul. 59, pp. 189, 190*).—In 1897 and 1898 comparative tests of Thomas slag (160 lbs. per acre), raw redondite (80 lbs. per acre), and roasted redondite (40 lbs. per acre) were made on plats of grass which had received nitrate of soda, 80 lbs., and kainit, 400 lbs. per acre. Barley was used as a nurse crop, and was cut in September, 1897. The yields of barley were as follows: On the Thomas slag plat, 1,312 lbs. per acre; raw redondite plat, 1,520 lbs., and roasted redondite plat, 1,424 lbs. The yields of hay in 1898 were on the Thomas slag plat, 3,704 lbs.; raw redondite plat, 4,320 lbs., and roasted redondite plat, 3,248 lbs. per acre.

"In each year, as is shown in the data, the raw redondite gave the greatest yield. Of the other two, the roasted redondite exceeded the Thomas slag by 112 lbs. per acre in the first year, while in the present season it was reversed, the Thomas slag yielding 456 lbs. per acre more than the other. From this experiment, therefore, their values are in the following order: Raw redondite, first; Thomas slag, second, and roasted redondite, third."

The fertilizing value of oil cakes, L. MALPEAUX (*Ann. Agron., 25 (1899), No. 3, pp. 111–126; abs. in Jour. Chem. Soc. [London], 76 (1899), No. 439, II, p. 378*).—This is an account of a continuation of previous field experiments supplemented by pot experiments. The results were very variable. As in previous experiments, sesame cake proved most effective, followed in the order named, by poppy, peanut, camelina, colza, castor bean, cotton seed, and palm cakes. This order may be changed by further experiments. For spring application the more rapidly decomposing poppy, sesame, and castor-bean cakes are recommended. They should be applied as early as possible.

Manurial requirements of crops, W. P. BROOKS (*Massachusetts Hatch Sta. Bul. 58, pp. 3-12*).—This is a brief summary of results and conclusions based upon experiments on twentieth-acre plats with various fertilizing materials, begun in 1889, a more complete account of which is to be given in a later bulletin. "The conclusions presented are based upon some 30 such experiments with corn, some 6 with oats, 12 with grass and clover, and 1 each with rye, soy beans, turnips, and cabbages," made at the station and in most cases also at other points in the State.

The experiments show in general that—

"The widest differences in plant-food requirements exist between crops cultivated upon the same soil; corn, clovers, rye, and soy beans being benefited mostly by potash; grasses and oats, by nitrogen; and mustard, cabbages, and Swedish turnips by phosphoric acid.

"The experiments indicate the desirability of changes in the composition of the complete 'special' fertilizers offered in our markets. For most crops these fertilizers contain too much phosphoric acid. For oats and grass they contain too little nitrogen.

"It is believed that for none of our crops, except those of the mustard family, is the application of phosphates to supplement farm manure called for."

Formulas for fertilizers for different crops are given.

Notes on the proper handling of barnyard manure, C. WELLINGTON (*Massachusetts Hatch Sta. Bul. 58, pp. 13-16*).—A general discussion, which is summed up as follows:

"Of the three common conditions of barnyard manure, half-rotted manure is the most valuable, and well-rotted manure the least, because of their relative amounts of nitrates.

"Manure should be kept packed away from the air as tightly as possible, and if rotted should be plowed under just before planting, otherwise several months before that time.

"The more litter used in the manure, the greater liability to loss of nitrogen.

"The use of bedding material free from decomposable organic matter is a means of protection against loss of nitrogen."

Commercial fertilizers (*Kentucky Sta. Bul. 79, pp. 159-197*).—Analyses and valuations are reported of 38 samples of fertilizers analyzed under the old fertilizer law and 67 samples inspected under the new law (E. S. R., 10, p. 336), with notes on valuation and selection of fertilizers, and extracts from the fertilizer law of the State.

Fertilizer inspection, C. D. WOODS (*Maine Sta. Bul. 50, pp. 8*).—Tabulated analyses of 142 manufacturers' samples of fertilizers licensed before March 8, 1899, with a summary of the chief provisions of the State fertilizer law.

Analyses of fertilizers, C. A. GOESSMAN (*Massachusetts Hatch Sta. Bul. 59, pp. 14*).—This bulletin gives a schedule of trade values of fertilizing materials in 1899 and analyses of 106 samples of fertilizing materials, including mixed fertilizers, wood ashes, limekiln ashes, marl, muriate of potash, sulphate of potash and magnesia, nitrate of soda, dried blood, meat and bone, fine ground bone, acid phosphate, bone ash, liquid fertilizer, plant food in tablet form, velvet beans, tobacco dust, damaged grain, water extract of dry forest leaves, and cotton-seed meal.

The inspection of fertilizers in 1898, F. W. MORSE (*New Hampshire Sta. Bul. 61, pp. 28*).—Analyses of 64 brands of fertilizers inspected in cooperation with the State board of agriculture are reported.

Analyses of licensed commercial fertilizers, 1899, F. W. WOLL and A. VIVIAN (*Wisconsin Sta. Bul. 73, pp. 10*).—The bulletin includes explanations of terms, notes on valuation, analyses of 5 samples of fertilizers, and the text of the fertilizer law of Wisconsin.

Sale of commercial or artificial fertilizers in South Australia, W. L. SUMMERS (*Jour. Agr. and Ind., South Australia, 2 (1899), No. 6, pp. 499, 500*).—The provisions of the Fertilizers Act Amendment Act of 1898 and the Fertilizers Act of 1894 are noted.

Fertilizers, E. HOTTER (*Düngerslehre. Graz: Landes-Versuchsstation, 1898, pp. 89*).—A brief general treatise on the nature, management, and use of manures and fertilizers.

Experiments in fertilizing irrigated meadows, M. ZECCHINI and R. NUVOLI (*Staz. Sper. Agr. Ital., 32 (1899), No. 1, pp. 15–32*).

The use of lees and marc of grapes as fertilizers, E. CHUARD (*Chron. Agr. Canton Vaud, 12 (1899), No. 9, pp. 209–211*).

The situation of the nitrate of soda industry of Chile, MAIZIÈRES (*L'Engrais, 14 (1899), Nos. 17, pp. 395–397; 18, pp. 420, 421*).

A study of the assimilability of the fertilizing constituents in various types of arable soils in the Department of Aisne, France, L. GAILLOT (*Bul. Sta. Agron. Aisne, 1898, pp. 30–41*).—An account is given of experiments on sugar beets with different combinations of fertilizers on 7 typical soils in earthenware pots holding 100 kg. of soil.

FIELD CROPS.

Fertilizer, culture, and variety experiments on cotton, R. J. REDDING (*Georgia Sta. Bul. 43, pp. 253–288*).—This is in continuation of work previously reported (E. S. R., 10, p. 139). Among 30 varieties of cotton African "Limbless," Lee Improved, Christopher Improved, Hawkins Prolific, Nancy Hanks, Russell Big Boll, Texas Oak, and Mascot, in the order given, rank first in the value of lint and seed produced. Russell Big Boll produced the largest yield of seed, Texas Oak the largest percentage of lint, and Mascot with King Improved ranked first in earliness. From the results of 5 years' work it is concluded that large bolls, large seed, and a high percentage of lint are closely connected with a high value of the total product.

The seed of an early and a late variety of equal productiveness mixed and planted together gave a better yield than when each variety was grown separately. The object of the experiment was to determine whether the ripening season could be lengthened and thus the capacity of the soil utilized to a fuller extent.

This season planting cotton 1 ft. apart in rows 4 ft. apart gave the best results. The average results for 8 years are also in favor of this distance. Varying the distance between plants in the row and the intervals between rows confirm the results of previous years (E. S. R., 10, p. 139).

Cotton-seed meal as a source of nitrogen for cotton was a little more effective than dried blood, but slightly inferior to nitrate of soda. Plats which received all the fertilizer application before planting gave an average yield of 1,407 lbs. of seed cotton per acre, while those on which one-tenth of the application had been applied in the furrow at the time of planting yielded on an average 1,389 lbs. per acre. The results from the general fertilizer tests were inconclusive.

Popular notes on the work of the station, rotation of crops, and the application of fertilizers are appended.

Experiments with cotton, 1898, J. F. DUGGAR (*Alabama College Sta. Bul. 101, pp. 19*).—These experiments comprise variety, fertilizer, and culture tests. Similar work has been previously reported (E. S. R., 10, p. 37).

Of 14 varieties of cotton tested, 9 yielded over 300 lbs. of lint per acre. The most prolific varieties were Russell Big Boll, Deering, Peterkin, and Smith Improved, which yielded 382, 341, 339, and 339 lbs. of lint per acre, respectively. Texas Oak produced the largest percentage of lint and Smith Improved stood first in earliness.

In the fertilizer test cotton-seed meal, acid phosphate, and kainit at the rate of 200, 240, and 200 lbs. per acre, respectively, were applied singly and in different combinations. The results show an average increase of 206 lbs. per acre in the yield of seed cotton with cotton-seed meal, 168 lbs. with acid phosphate, and 230 lbs. with kainit. This experiment was conducted on a gray sandy soil, and all fertilizers yielded a profit. Applying all the fertilizer in the center furrow gave better results than applying two-thirds or all of it in the two listing furrows. A comparison of rotten cotton seed, cotton-seed meal, and nitrate of soda gave inconclusive results.

An experiment was made with potash fertilizers to determine their effectiveness in decreasing the black rust of cotton. It was shown that the use of 50 lbs. of muriate of potash and 200 lbs. of kainit per acre, supplying equal quantities of potash, were equally effective. One hundred pounds of kainit per acre reduced the amount of rust, but the application of 60 lbs. was less effective in causing the plants to retain their leaves.

Subsoiling late in February failed to increase the yield.

Cooperative fertilizer experiments with cotton in 1898, J. F. DUGGAR (*Alabama College Sta. Bul. 102, pp. 23–94*).—These experiments are in continuation of work formerly reported (E. S. R., 10, p. 431). Of the soil tests made this season in 41 localities of the State, 30 gave conclusive results, and these are discussed at some length and tabulated in detail. The inconclusive experiments are considered briefly. The fertilizer applications were the same as the year before, namely, 200 lbs. of cotton-seed meal, 240 lbs. of acid phosphate, and 100 or 200 lbs. of kainit, applied singly, in twos, and all three together.

Acid phosphate was found effective on a greater number of soils than the other fertilizing materials when applied alone. As in the previous year, the application of 200 lbs. of cotton-seed meal, 240 lbs. of acid phosphate, and 100 lbs. of kainit per acre gave the best financial results in the greater number of localities. The two complete fertilizer applications increased the yield of seed cotton 392 and 435 lbs. per acre, the application containing 200 lbs. of kainit giving the smaller increase. Acid phosphate and cotton-seed meal applied together gave an average increase of 339 lbs. of seed cotton per acre, and the increase of other applications ranged from 113 to 287 lbs. per acre.

Conclusions as to the fertilizer requirements for cotton on different soils in various parts of the State are drawn from the results, and fertilizer applications are suggested.

Seeding grass lands with vs. without a nurse crop, F. W. RANE, (*New Hampshire Sta. Bul. 59, pp. 183–187, fig. 1*).—In the spring of 1897 a mixture of 5 lbs. of alsike clover, 7 lbs. of red clover, 5 lbs. of red top, and 12 lbs. of timothy per acre was sown with and without a nurse crop. Barley was used as the nurse crop and was sown at the rate of 3 pecks per acre. The first season the crop grown with barley gave the best returns, but when the yields of two seasons were taken together, the difference was not so marked. The excess in yield of hay for the two seasons, in favor of the crop grown with barley, was 3,662 lbs. The author believes that in general for New Hampshire conditions it is advisable to sow grass seed with a nurse crop. A similar experiment has been previously reported (E. S. R., 10, p. 429).

Field experiments, J. A. MURRAY and T. H. MIDDLETON (*Agr. Dept., Univ. Col. Wales, Aberystwyth, 1898, pp. 42*).—The experiments here reported were comparative tests with fertilizers, and the results are tabulated. From the results on grass land it is concluded that nitrogenous manures, when used alone, are detrimental to the fertility of the soil and the quality of the grass. An application of 3 cwt. of basic slag and 2 cwt. of nitrate of soda per acre is considered a profitable dressing. As compared with the application of 6 cwt. per acre, 10 cwt. of basic slag gave an increase in the yield of hay proportional to the extra quantity of fertilizer applied.

The chlorid and sulphate of calcium, potassium, and sodium were used in connection with superphosphate as fertilizers for mangel-wurzels. Calcium sulphate produced no effect, while the chlorid materially reduced the yield. The potash and sodium salts increased the yield. Sodium sulphate gave better yields than sodium chlorid. Asparagus plants were benefited by an application of sodium chlorid, and to a still greater extent by an application of sodium sulphate. Common salt proved injurious to grass when applied in quantities which were not harmful to mangel-wurzels.

The results of an experiment on the relation of certain fertilizers to the yield of meadow hay showed that on the average nitrate of soda slightly decreased the crop; that superphosphate of lime, on the average, yielded a profitable increase, and that the use of kainit gave large and profitable returns. In conjunction with nitrate of soda and in the absence of potash fertilizers, lime gave good results; but on the average it decreased the yield of hay. It is recommended to apply 2 cwt. of basic slag in the fall and 1 cwt. superphosphate and 4 cwt. of kainit in the spring as a fertilizer for meadows.

Basic slag as a fertilizer in hay farming, A. T. NEALE (*Delaware Sta. Bul. 43, pp. 19–24*).—This article is a discussion of the advantages of basic slag as a fertilizer and the obstacles in the way of its general introduction. The experimental work with basic slag at several experiment stations is briefly reviewed, and the results of experiments at the station are reported.

Grass was sown with rye in 1897 and the plats were fertilized with bone, acid phosphate, and basic slag, furnishing 72, 42, and 54 lbs. of phosphoric acid per 300 lbs., respectively. The results are given in the following table:

Yields of rye and hay fertilized with different forms of phosphoric acid.

Kind of fertilizer.	Amount applied per acre.	Yield of rye per acre in 1897.		Yield of hay per acre in 1898.
		Grain.	Straw.	
	Pounds.	*Bushels.*	*Pounds.*	*Pounds.*
Bone and acid phosphate	300	21.4	2,414	5 383
Acid phosphate	300	22.8	2,661	4,788
Basic slag	400	17.9	1,922	5,391
None		18.2	2,083	4,605
Basic slag	800	17.0	2,100	4,644
Ground bone	300	16.9	1,543	4,992
Basic slag and acid phosphate	300	20.4	2,213	5,171

It is concluded that the acid phosphate had been exhausted by the grain, while bone and slag still had a good effect on the succeeding hay crop.

Experiments with rape, W. GRASHOFF (*Jour. Landw., 47 (1899), No. 1, pp. 85–90*).—Experiments were made to determine the influence of soil and fertilization on the fat content of rape seed. The method of conducting the experiments is described, and the results are tabulated. The author concludes, from the results obtained, that the character of the soil and the fertilizer have a marked influence on the fat content. The difference of fat content of seed grown on diluvial sand and "kohlenkeuper" was 5 per cent. The soil of the "kohlenkeuper" division (upper division of the Triassic) produced the largest yields and the highest fat content in the seed. Fertilizing with phosphoric acid increased the fat content over 2 per cent. The nitrogen content and the fat content of the seed seemed to be in direct relation to each other. The seed produced on "kohlenkeuper" showed the highest fat content and the lowest nitrogen content, and the seed obtained from soil fertilized with nitrogenous fertilizers was richest in nitrogen and poorest in fat.

Sorghum in 1898, C. L. PENNY (*Delaware Sta. Bul. 44, pp. 16*).—This is in continuation of work formerly reported (E. S. R., 10, p. 345).

The experiments were cooperative, and the results with the several crops at different times during the season are tabulated in detail. The "Brix method" and "glucose method" for determining the available sugar are compared.

The varieties of cane grown were Amber, McLean, and Orange. The percentage of sugar in the juice of Amber cane ranged from 12.89 to 17 per cent, with an average of 15.41 per cent for seven different crops. Only one crop each of McLean and Orange were grown, and in these the percentage of sugar in the juice was 14.79 and 11.61 per cent, respectively.

The crop of Amber cane which gave the best yield of available sugar per acre contained the least available sugar per ton of cane, while a crop which was one of the lowest in available sugar per acre stood next to the highest in available sugar per ton. "It is evident enough that the stand of cane is of prime importance. A shortage in that can not be supplemented by any richness whatever in sugar content."

Comparing the stalks of the crop of the previous year from the seed of which this season's crop was grown, it is shown that while the selection was made on the basis of the weight of the parent stalk the stalks of this season are practically equal in weight, and that the percentage of solids and of sugar in the juice is lower than in the parent stalk.

A few experiments were made to study the effects of blading the cane. The stalks were bladed from 10 to 17 days before cutting, and the results obtained show an increase of approximately 15 per cent of sugar in the juice, 4 per cent in the purity, 7 per cent in the tonnage of cane per acre, and 34 per cent in the available sugar per acre.

Sugar-beet investigations in 1898, A. D. SELBY (*Ohio Sta. Bul. 99, pp. 77-122, fig. 1*).—These investigations are in continuation of the previous year's work (E. S. R., 10, p. 346). The bulletin contains the detailed results of cooperative sugar-beet experiments for 1898, and gives complete directions for the culture of sugar beets, short notes on diseases and insects attacking the sugar-beet, and tabular statements of the weather conditions for the growing season.

The results of analyses of 498 samples grown throughout the State show an average weight per beet of 22.7 oz., and an average sugar content in the beet of 11.4 per cent, with a purity of 77.9. The results are not as satisfactory as those of 1897, and it is believed that insect and fungus injuries caused the decline. The average results are in favor of the northern and northeastern parts of the State, in which the most favorable theoretical conditions prevail.

Conditions pertaining to beet-sugar factories are discussed and analyses of certain water and limestone supplies of the State are given in tables.

Sugar beets in South Dakota for the year 1898, J. H. SHEPARD and W. H. KNOX (*South Dakota Sta. Bul. 62, pp. 35–82, figs. 10, pls. 6*).—Twenty cooperative experiments in the culture of sugar beets were conducted in five different localities of the State to determine the tonnage of beets per acre that might be obtained and the cost of production. The bulletin contains meteorological data, directions for sugar-beet culture, and the reports on the results in the different localities.

Vilmorin and Kleinwanzlebener were the varieties grown in these tests. The average results for all experiments were as follows: Sugar in the juice, 18.44 per cent; purity, 88.91 per cent; yield per acre, 16.30 tons; cost of production per acre, $37.64. The percentage of sugar ranged from 16.40 to 21.20 per cent, the purity from 79.70 to 94 per cent, the yield per acre from 6.50 to 32.90 tons, and the cost per acre from $19.10 to $53.77. In six instances the yield per acre was less than 12 tons. The small yields were caused mainly by late planting and insect attacks.

Sugar-beet investigations in Wisconsin during 1898, F. W. WOLL (*Wisconsin Sta. Bul. 71, pp. 34, fig. 1*).—The investigations in sugar-beet culture were conducted in 1898 as in the previous year (E. S. R., 10, p. 39). This bulletin reports the results of analyses of beets grown by farmers in different parts of the State and considers the experiment in sugar-beet culture made at the station.

The samples analyzed numbered 253, and they were furnished by 121 farmers in 56 different counties. They were taken at two different periods, 151 at harvesting time and 102 about one month before. The early samples had an average sugar content in the juice of 14.84 per cent with a purity of 78.8 per cent, and the samples taken later contained 15.36 per cent sugar in the juice, with a purity of 78 per cent. The average weight of the beets in the samples was 1.4 lbs. The average yield per acre was estimated at 12.6 tons.

Sugar-beet experiments have been carried on in the State during 5 seasons since 1890, and the analyses of 2,537 samples obtained from this work, not including samples grown at the station, showed an average of 13.59 per cent of sugar in the juice, and an average coefficient of purity of 77.7. The average yield of beets per acre for the samples grown during the 5 seasons is given as 15 tons.

The use of lime as a fertilizer for beets produced an increase in the sugar content in 6 cases, and a decrease in 2 cases, while in 1 instance no difference was noticeable. The average results were in favor of liming.

The average cost of growing an acre of beets as reported by 36 growers was $28.80.

A test of 15 varieties was made at the station on 2 fields of different grades of fertility. The less fertile of the 2 fields was fertilized with 360 lbs. of sulphate of potash, 360 lbs. of dissolved bone, and 400 lbs. of nitrate of soda per acre. The unfertilized field yielded 19.8 tons and the fertilized field 17.5 tons of beets per acre, and in most cases the sugar content of the beets from the unfertilized field was the greater. Of the varieties tested by the station, French Very Rich, and Pitzschke

Elite gave the best results. Analyses showed that the sugar content of varieties grown by outside parties decreased in the following order: Kleinwanzleben, Zeringen, French Very Rich, Kleinwanzleben Improved, Vilmorin Improved, and Kleinwanzleben Nebraska.

Fertilizer experiments on marshy soil were continued. This season the soil was fertilized with 130 lbs. of potash, 65 lbs. of phosphoric acid, 56 lbs. of nitrogen, and 1 ton of lime per acre, applied in different combinations. The fertilizers were applied in the form of sulphate, muriate, and silicate of potash, double carbonate of magnesia and potash, superphosphate, and nitrate of soda. The yield obtained was 13.65 tons of beets and a little over 2 tons of sugar per acre. The richest beets contained 16 per cent of sugar and were grown on a plat fertilized with bone phosphate and muriate of potash. The plat which had received nitrate of soda, potassium sulphate, and bone phosphate produced beets with a sugar content of 15.9 per cent. On most of the plats the increase in tonnage and sugar was obtained at a cost below that of the fertilizers applied. The author concludes that with good culture and proper fertilization, beets with a sugar content of 4 per cent above the factory standard can be grown on soil that contains almost 20 per cent of organic matter.

Experiences and results in breeding new varieties of plants, O. PITSCH (*Deut. Landw. Presse, 26 (1899), Nos. 21, pp. 221, 222; 23, pp. 249, 250; 25, pp. 273, 274; 30, p. 335; 31, p. 350; 34, pp. 383, 384*).—Notes on the results of breeding new varieties of potatoes, wheat, and barley.

Report of the Cawnpore Experimental Farm for the Kharif and Rabi seasons of 1897–98, S. M. HADI (*Allahabad, 1898, pp. 34, map 1*).—This is a report of the crops grown at this farm in British India during the fall of 1897 and the spring of 1898. The experiments consisted of fertilizer, variety, culture, and implement tests.

The results obtained indicate that indigo refuse, especially when old, is a better fertilizer than green crops plowed under. American and other foreign varieties of cotton were found superior to the native varieties, but it is believed that exotic cottons are more apt to deteriorate than other varieties. American wheat and Canadian oats were grown with good success.

The development of the production of fodder beet seed, H. K. GUNTHER, (*Fühling's Landw. Ztg., 48 (1899), Nos. 10, pp. 394–396; 11, pp. 414–417*).—A popular article discussing the improvement of the field beet. Some historical data are given and a number of varieties described.

Coffee in Porto Rico, A. C. HANSARD (*Planting Opinion, 4 (1899), No. 16, pp. 295–297*).—This article describes in a popular way how coffee culture is carried on in Porto Rico.

Coffee in Queensland (*Planting Opinion, 4 (1899), No. 19, pp. 351, 352*).—A popular note on the cultivation of coffee.

Further experience in the culture of corn for grain, F. VON LOCHOW (*Mitt. Deut. Landw. Gesell., 14 (1899), No. 8, pp. 106–109*).—This is a report on a test of 44 varieties of corn, including many American varieties. The results and the descriptions of varieties are given in tabular form.

The story of the cotton plant, F. WILKINSON (*New York: D. Appleton & Co., 1899, pp. 191, figs. 38*).—This is one of The Library of Useful Stories published by this firm. The topics treated are origin, growth, and descriptions of the chief cultivated species; cotton-plant pests and other injurious agents; cultivation of cotton in different countries; the microscope and cotton fiber; plantation life, and the early cleaning processes, including picking, ginning, and baling; manipulation of cotton in opening, scutching, carding, drawing, and fly frames; early attempts at spinning, and early inventors; further developments by Arkwright and Crompton; the modern spinning mule; other processes in the spinning of cotton; and destination of the spun yarn.

Cowpeas, J. G. SMITH (*U. S. Dept. Agr., Farmers' Bul. 89, pp. 16, fig. 1*).—This publication is a popular bulletin discussing the value and use of the cowpea for soil renovation, forage, and silage. Complete notes are given on the cultivation and harvesting of the crop and the method of harvesting the seed. Varieties and the variations occurring when grown under different climatic conditions are described, and the feeding value of the crop is pointed out by comparison with that of other common forage crops.

Sowing crimson clover in different months, F. W. RANE (*New Hampshire Sta. Bul. 59, pp. 188, 189, fig. 1*).—Crimson clover was sown June 29, July 31, August 31, October 10, and November 7. The plants sown early attained a fair size, but only a few withstood the winter. A mixture of medium red and alsike clover is considered more valuable than crimson clover for that climate. Tests with crimson clover have been reported in a former bulletin (E. S. R., 8, p. 586).

Russian flaxseed in its relation to German flax culture (*Deut. Landw. Presse, 26 (1899), Nos. 32, pp. 360, 361; 33, p. 373*).—A popular article discussing at some length the kinds of flaxseed produced in various parts of Russia and their importance to flax culture in Germany.

Drilling grain (*Landw. Wchnbl. Schleswig-Holstein, 49 (1899), Nos. 15, pp. 277-280; 16, pp. 295-298*).—This article is a popular presentation of the subject, pointing out the advantages of the use of the drill. The opinions of several investigators on the subject are given.

How shall we prevent the lodging of grain? SÄUBERLICH (*Fühling's Landw. Ztg., 48 (1899), No. 9, pp. 336-342*).—This article discusses in a popular way how to fertilize, cultivate, and rotate the crops in order to prevent the lodging of grain.

Top-dressing grass lands, F. W. RANE (*New Hampshire Sta. Bul. 59, pp. 187, 188*).—An acre of grass land was dressed in the spring with 100 lbs. of nitrate of soda, 100 lbs. of dissolved boneblack, and 50 lbs. of muriate of potash, while another acre of grass land served as a check plat. The first season the fertilized plat yielded 910 lbs. and the second season 820 lbs. of hay more than the unfertilized plat.

Pastures and grasses suitable for making hay, P. H. MELL (*Alabama College Sta. Bul. 100, pp. 318, 319*).—A note is given on the preparation of land for the establishment of pastures, and the different pasture grasses recommended are briefly described.

Hop growing on irrigated lands, J. SHOMAKER (*Amer. Farm. Mag., 5 (1899), No. 5, pp. 353-356, figs. 4*).—A popular article on hop growing in the Yakima Valley, Washington.

Lime as a fertilizer for hops (*Sächs. Landw. Ztschr., n. ser., 21 (1899), No. 14, p. 155*).—A note giving the results of experiments made by S. Hannamann and L. Kourinsky at Postelberg, Austria. Hops were grown on a soil poor in lime. An application of 3,400 kg. of lime per hectare increased the crop 402.6 kg.

Cultivation of oats in the Rhine Province and the varieties best adapted to the region, OSTERSPEY (*Ztschr. Landw. Ver. Rheinpreussen, 16 (1899), No. 14, pp. 123-125*).—A popular discussion on the cultivation of oats, giving a comparison of 7 varieties tested for several years.

Extra early potatoes, W. E. HALL (*Gardening, 7 (1899), No. 157, pp. 202, 203*).—Uncut potato tubers were set in shallow boxes with the blossom ends up and three-fourths covered with sand. The boxes were placed in rather subdued light at a temperature of 50 to 60°. Twenty-seven days later the tubers were carefully removed from the sand and placed in the field in the same position which they had occupied in the box. This lot matured from 7 to 10 days earlier than another lot planted directly from the bin. The first lot was also several days earlier than a third lot similarly treated, with the exception that it was not put in sand.

Report on F. Heine's comparative variety tests with potatoes, in 1898, at Kloster Hadmersleben, K. KITTLAUSZ (*Deut. Landw. Presse, 26 (1899), No. 30, pp. 339–342*).—A report on the results of a comparative test with over 100 varieties of potatoes. The results are given in tables and discussed at some length.

Sugar cane grown in soils containing salts, H. WINTER (*Arch. Java Suikerind., 1898, July 1; abs. in Sugar Cane, 30 (1898), No. 350, pp. 482, 483*).—This article treats of the effect of salts in the soil on the composition of cane juice.

The influence of the arrowing of cane on its saccharine content, H. C. PRINSEN-GEERLIGS (*Sugar Cane, 30 (1898), Nos. 346, pp. 258, 259; 349, p. 395*).—From the experiments reported it appears that the process of arrowing or flowering of the cane only very slightly diminishes its saccharine content.

On some constituents of the sugar cane, M. RACIBORSKI (*Sugar Cane, 30 (1898), No. 350, pp. 474–478*).—This article is a discussion of a chemical study of sugar cane. It is concluded from the results that sugar cane contains a chemical substance having the property of oxidizing guaiacum, and which exercises the same function in connection with the respiration of plants as hæmoglobin and hæmocyanin in that of animals. The author proposes to name the substance "leptomin."

A review of the methods of purchasing cane, whether by test or otherwise, W. C. STUBBS (*Audubon Park, New Orleans, La., 1899, pp. 12*).—A paper read before the Louisiana Sugar Planters' Association, in which the equitable division of profits between the grower and the manufacturer, the method of predicating an output of sugar from an analysis of the cane, and the methods of sampling cane are discussed.

Experiments with sweet potatoes, G. W. CARVER (*Alabama Tuskegee Sta. Bul. 2, pp. 15, figs. 5*).—This bulletin reports on the results of fertilizer tests with sweet potatoes and gives general directions for the culture of the crop. On account of adverse conditions the experiments were not conclusive.

Tobacco culture in the German colony of New Guinea (*Deut. Landw. Presse, 26 (1899), No. 32, pp. 359, 360, figs. 8*).—A brief popular description of tobacco culture as it is carried on in the German colony of New Guinea.

HORTICULTURE.

Green corn under glass, F. W. RANE (*New Hampshire Sta. Bul. 60, pp. 16, figs. 7*).—The author believes he has demonstrated that the forcing of green corn, an industry as yet practically unknown, may be profitably undertaken.

The forcing house should have 3½ to 8 ft. clear space above the bed, according to the variety to be grown, and should be capable of maintaining a temperature of 75° or more during the day and not lower than 60°, or better 70°, at night. Shade is not necessary. Any fertile greenhouse soil may be used.

Much time may be gained by soaking the seed and planting in pots, taking care to transplant, however, before the plants become root bound. Experiments indicate that the rows should be 18 inches apart, and the plants 9 inches in the row. The only training found necessary was the removal of suckers. One-half the tassels may also be removed without injuriously interfering with pollination. More strength is thus thrown into the ear. In these experiments the crop was matured in about 88 days.

"By keeping a high temperature and devoting a whole house to corn, it is believed that this crop could be harvested in a much shorter period. It usually takes from 12 to 15 weeks to mature lettuce from seed. While, of course, corn requires more space in the house, it is readily seen that it can be grown with as quick results; also, were we able to produce 2 ears per plant, an ear of corn would represent the product from about the same space that a head of lettuce occupies."

The varieties tested were Early Minnesota, Crosby Early, White Cob, First of All, Early Fordhook, and Adams Extra Early. Notes are given on each.

"The varieties found to do very well were Crosby Early, First of All, and White Cob. The White Cob was the earliest, but Crosby Early was thought to be more desirable. Other varieties we believe well adapted to forcing are the following: Extra Early Beverly, Eastman Early, and Early Fordhook. From our experience with the above-named varieties, I believe we can depend upon almost any variety that is desirable out of doors to be equally valuable under glass. Moreover, if proper heat, moisture, and a rich soil be given, a crop will mature in the greenhouse in a shorter time than in the garden. In the forcing house, with the exception of light, we can have almost ideal conditions. With the use of the electric light, even the cloudy weather of winter can be overcome to a degree."

Until the corn is 6 weeks old, the space between the rows may be utilized for catch crops. Radish and Grand Rapids lettuce gave best results as such.

The only pests to contend with are rats and mice. These dig up the seed and rats also attack the maturer corn, eating the more succulent parts, especially the ears. They should be exterminated before planting the crop.

Forcing pole beans under glass, F. W. RANE (*New Hampshire Sta. Bul. 62, pp. 29–36, figs. 2*).—The author has forced pole beans under glass successfully. The greenhouse requirements and methods of procedure are about the same as in the case of green corn (p. 147). Plants were trained both on poles and string trellises. The latter method gave better results. The bean is self-fertile, hence does not need to be cross pollinated. The time from germination to maturity ranged from 54 to 62 days. Beans planted in hills, 18 in. apart each way, with 2 to 3 plants to the hill, bore well. Practically no trouble from insects or fungi attended the growing of the crop. Comparative trials were made with dwarf and pole beans under glass. The fruiting period was divided into 8 pickings. The larger part of the dwarf beans were gathered in the first 3 pickings. "The pole beans are much more productive than the dwarf varieties. Not only is this true in the first 3 pickings, but they continue to yield good returns for a much longer period. The time from germination to maturity is a trifle longer perhaps with pole beans than with the dwarf varieties."

Some peach notes, H. N. STARNES (*Georgia Sta. Bul. 42, pp. 207–220; 230–250d, figs. 5, pl. 1*).—The various operations of peach culture are reviewed in considerable detail, and descriptive notes are given on 95 varieties of peaches. The following fertilizer for bearing trees is recommended: Three pounds high-grade acid phosphate, 1 lb. muriate of potash, and 1 lb. cotton-seed meal.

Tests were made to determine the resistance of the foliage of the

Elberta peach to various strengths of standard insecticides and fungicides. The results indicate that normal Bordeaux mixture is liable to injure the foliage of this variety, but when diluted to ½ or ¾ normal strength it may be used with safety.

Tests were made to determine the relative resistance of different varieties to normal Bordeaux mixture. Varieties were found to differ greatly in this respect and extremes were widely separated. The 69 varieties tested are grouped as follows:

"*Varieties extremely resistant.*—Bishop, Clifton Cling, Crimson Beauty, Crosby, Florence, Josephine, Mamie Ross, Mountain Rose, Picquett Late, Plant Seedling, Sallie Worrell, Triumph, and Wallace.

"*Varieties quite resistant.*—Admiral Dewey, Albert Sidney, Carman, Champion, Crawford Early, Early Tillotson, Fleitas St. John, Halo Early, Husted No. 50, Husted No. 52, Husted No. 51, Husted Extra Early, Lady Ingold, Miss Lola, Muir, October Beauty, Pace, Reeve Favorite, R. E. Lee, and Spottswood.

"*Varieties moderately resistant.*—Globe, Hill Chili, Robert, Sneed, Sylphide.

"*Varieties easily affected.*—Alexander, Baldwin Late, Bokhara No. 3, Bustian October, Chinese Cling, Elberta, Emma, Heath Cling, Hoover Heath, Husted No. 53, Lonoke, Oldmixon Free, Susquehanna, Waddell, and Wheatland.

"*Varieties quite easily affected.*—Chinese Free, Connecticut, Crawford Late, Early Michigan, Indian Blood, Stonewall Jackson, and Stump the World.

"*Varieties extremely sensitive.*—Diamond, Henrietta, Oldmixon Cling, Old Newington Cling, Pallas, Salway, Smock, and Thurber."

A preliminary account is given of a fertilizer test made to observe, through a series of years, the effect of radically different fertilizers on peaches. The fertilizers used were acid phosphate, muriate of potash, kainit, and cotton-seed meal alone and in various mixtures. An application of 20 lbs. of kainit per tree proved fatal. The most promising mixture consisted of 4 lbs. of acid phosphate and 1 lb. of muriate of potash per tree.

Persimmons, R. L. WATTS (*Tennessee Sta. Bul. Vol. XI, No. 1, pp. 191–219, figs. 10*).—This bulletin is a horticultural treatise on the persimmon, both American and Japanese, in Tennessee. The distribution of each group in the United States, and the botanical characters are discussed, and the most important varieties of each enumerated and described.

The American persimmon.—The American persimmon is considered a promising fruit commercially. The very limited culture which it now receives is profitable, and the supply is not equal to the demand. These conditions have been an incentive during the last few years to the amelioration of the wild types. The species are very variable and offer inviting opportunities to the plant breeder.

"We should have earlier ripening varieties. A persimmon one-third larger in size than any thus far introduced would be a valuable acquisition. The numerous large seeds found in most persimmons are objectionable; and one purpose in creating new varieties should be to reduce the number of seeds. A seedless variety comparatively free from astringency, as large as some of the Japanese class and ripening before the advent of frost in most sections of the South, would be one of the most valuable fruits that have ever been introduced."

The various topics of soil, location, cultivation, and propagation are discussed in detail. A large supply of nitrogenous matter in the soil is not necessary for the best development of tree and fruit, but a liberal supply of phosphoric acid, and particularly potash, is essential to secure the best results. It is believed that excessive cultivation is one cause of premature dropping of fruit in the Japanese species.

The Japanese persimmon.—Historical notes are given on the Japanese persimmon in America. On its own roots and in its native habitat the tree is of medium size. It is considered probable that in this country when worked on the native persimmon it will attain to a much greater development.

Fruits of the Japanese persimmon vary greatly in size, shape, smoothness, color of skin, and flesh. With the color of the flesh are correlated several characters or qualities of fruit, as astringency, consistency, and number of seeds.

The culture of the Japanese persimmon is practically the same as that of the native species. Three methods are given for obtaining Japanese persimmons of home production: (1) Cleft grafting the root of the common persimmon in the nursery row. This is the best method when a number of trees are wanted for orchard planting. (2) Cleft grafting small wild trees of the common persimmon; and (3) top working old trees of the common persimmon.

The Japanese persimmon requires but little pruning. Thinning is, however, necessary, if a considerable quantity of the fruit does not fall prematurely, in order to secure larger and finer fruits, uniform annual crops, and to promote longevity. It is the belief of one large grower that in the South overbearing kills 60 per cent of all trees that die from various causes.

Notes on the chemistry of the persimmon, J. B. McBryde (*Tennessee Sta. Bul. Vol. XI, No. 1, pp. 220–223*).—Analyses were made of both wild and cultivated persimmons, the results of which are shown in the following table:

Composition of persimmons.

	Average weight of fruit.	Seed in fruit.	Sugar.		Total acid in pulp.	Proximate analysis of pulp.			
			In pulp.	In fruit.		Water.	Crude protein.	Fats and carbohydrates.	Crude ash.
	Gms.	*Per cent.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
No. 1. Hachiya	180.0	Seedless	16.83	16.83	0.13	71.77	0.93	26.42	0.88
No. 2. Tsuru	194.0	....do ...	15.67	15.67	.16	73.45	.74	25.16	.64
No. 3. Hiyakume	175.0	1.71	17.83	17.52	.13	70.17	1.10	27.58	1.15
No. 4. Yemor	150.0	Seedless	15.99	15.99	.10	76.26	.45	22.69	.60
No. 5. Japanese graft on native	103.0	... do ...	16.55	16.55	.11	75.00	.42	24.13	.45
No. 6. Wild	6.6	15.5	18.72	15.74	.26	66.78	.64	31.32	1.26
No. 7. Wild	8.9	17.5	23.50	18.19	.15	57.24	.58	41.34	.84
No. 8. Wild	9.2	16.3	23.48	19.35	.17	57.25	.48	40.99	1.28

In a comparison of these analyses with others already reported (E. S. R., 8, pp. 229, 701) it was found "that the wild fruit contains 1¼ per cent more sugar than the cultivated fruit, and, furthermore, that they contain nearly 13 per cent more dry matter. On the other hand, the cultivated fruit is higher in protein. While these figures are, no doubt, correct for the samples so far examined, it will not do to be too hasty in drawing conclusions. . . . The most striking thing shown by these analyses is the large proportion of sugar, which in this fruit is all in the form of glucoses. Thorough tests failed to show a trace of cane sugar."

Small fruits in 1898, E. S. GOFF (*Wisconsin Sta. Bul. 72, pp. 37, figs. 51*).—Notes are given on a considerable number of the newer varieties of strawberries, raspberries, blackberries, currants, and gooseberries, and many of them are figured. The Loganberry, golden mayberry, strawberry-raspberry (*Rubus sorbifolius*), and Japan wineberry (*R. phœnicolasius*) are reported on unfavorably. A comparative study of varieties of currants was made with regard to vigor of growth, productiveness, size of fruit, and percentage of waste in the manufacture of jelly.

An experiment was made of postponing spraying the currant for *Septoria ribis* until after the harvest, thus avoiding smearing the fruit. Sprayed bushes retained their foliage 4 to 6 weeks longer than those not sprayed. Notes are also given on the relative vigor of growth and resistance to Septoria and mildew of different varieties of gooseberries.

Of the varieties of fruits reported in this bulletin the following are considered the most desirable: *Strawberries*—Wm. Belt, Clyde, and Splendid; *raspberries*—for the table, Loudon; for canning, Columbian; *blackberries*—El Dorado; *currants*—Raby Castle; *gooseberries*—Downing.

Small fruits: Culture notes and comparison of varieties, W. J. GREEN (*Ohio Sta. Bul. 98, pp. 61-76*).—In an experiment in soil culture 1 plat of strawberries was hoed and a second was worked with a cultivator just enough to keep down the weeds; a third plat was cultivated at least twice a week when the weather permitted, and always as soon as possible after a fall of rain. Determinations of soil moisture showed that plat 3 held more moisture throughout the season, the excess at times amounting to the equivalent of ½ in. of rain. The rainfall throughout the season was abundant generally.

Varieties differed greatly in the benefit derived from frequent cultivation. Of 3 varieties tested Tennessee Prolific on plat 3 showed an increased yield of 68 per cent over plat 1, while Haverland showed only 10 per cent. The use of a plank clod-crusher in cultivation is recommended for at least half the time rather than a cultivator all the time.

Notes are given on a considerable number of varieties of small fruit.

Kainit as a fertilizer for the grape, J. FARCY (*Prog. Agr. et Vit. (Ed. L'Est), 20 (1899), pp. 348-350*).—Tests were made of kainit as a substitute for sulphate of potash in manuring grapes. Five plats of 100 vines each on light porous soil received the treatments and gave the yields shown in the following table:

Fertilizer experiment with grapes.

Plat.	Fertilizer.	Amount.		Yield.		Density of must.
		Per plat.	Per hectare.	Per plat.	Per hectare.	
		Kg.	*Kg.*	*Kg.*	*Kg.*	°*B.*
1	Kainit	30	900	146.5	4,395	10.50
2	Superphosphate	20	600	196.5	5,895	9.50
3	Check	....	....	165.5	4,965	10.50
4	Kainit Superphosphate	30 20	900 600	148.0	4,440	10.00
5	Kainit Superphosphate Nitrate of soda	30 20 10	900 600 300	165.0	4,950	10.00

The effect of the kainit was plainly detrimental. On plats 4 and 5 the action of the superphosphate, from the use of which the high yield of plat 2 was obtained, was paralyzed by the kainit. The kainit did not appear to have any adverse effect on the density of the must, however, while on the contrary the superphosphate did.

The ill effects of the kainit in this experiment were apparently due to the impurities mixed with the sulphate of potash, chief among which are the chlorids of sodium and magnesium, the latter especially being very injurious. Fortunately magnesium chlorid is very soluble and is not retained by the soil; hence ill effects resulting from the use of kainit may be avoided by applying it early the fall before, giving the winter rains opportunity to wash away the injurious constituent. If this precaution is observed, kainit may be used as a fertilizer for the grape on permeable soils.

Latest facts about grafted roses for winter forcing, A. B. Scott (*Amer. Florist, 11 (1899), No. 558, pp. 817, 818*).—American Beauty, Kaiserin Augusta Victoria, Perle des Jardins, Bride, Bridesmaid, and Liberty roses were grown on their own roots and also grafted on Manetti stocks. All except American Beauty and Perle des Jardins did much better as grafts. The author concludes from his experiments that grafted roses will make strong, vigorous plants much quicker than roses on their own roots. They also produce as many, if not more, flowers, and a larger proportion of the flowers are extra fine. The roots are comparatively free from disease, and thus far in transplanting grafted plants no evidence of eel worms has been discovered. Grafted roses are said to have more vitality than roses on their own roots.

Manetti is considered the most desirable of the different varieties of stocks.

Ringing roses to facilitate propagation by cuttings, Greiner (*Bul. Soc. Cent. Hort. Seine-Inférieure, 2. ser., 2 (1898), No. 6, pp. 380,* *381*).—The stem or branch of the rose is ringed the latter part of July or August, causing the formation of a callus before the cutting is removed in November. Cuttings thus treated strike root much more readily than ordinary cuttings, which can make roots only after having formed a callus. By this method the propagation of varieties which can not be propagated by cuttings except with great difficulty, is rendered simple. Several rings may be made on the same branch by observing the proper distance for cuttings.

Report of the department of horticulture, F. W. RANE (*New Hampshire Sta. Bul. 59, pp. 190–192*).—Notes on commercial fruit culture in New Hampshire in 1898. Short lists of apples, pears, plums, and cherries adapted to the State are given, as reported by growers.

Hybridization, J. H. WILSON (*Amer. Gard., 20 (1899), No. 233, pp. 415–417, figs. 6*).—An historical essay.

Hybridization, G. W. OLIVER (*Amer. Gard., 20 (1899), No. 232, pp. 397–400, figs. 4*).—An essay treating of the history, principles, purpose, and limits of hybridization and sterility of hybrids.

Commercial fruit culture in North America, Y. NYEMETZ (*Promuischlennoe Plodovodstvo va Syevernoi Amerikye. St. Petersburg: I. Kirschbaum, 1899, 2. ed., pp. 388, figs. 223*).—This book is a report of observations made during a journey through the United States. There is a chapter devoted to instruction in horticulture in the United States, and special chapters on the apple, pear, quince, peach, apricot, plum, cherry, grape, small fruits, and garden vegetables.

Some of the more common fungus and insect diseases are mentioned, and the American remedies for fighting them are described.

Types of fruit and their persistence under cultivation, J. CRAIG (*Gardening, 7 (1899), No. 162, pp. 278, 279, figs. 2*).—Especially illustrated by the Borsdorf apple, a variety that has been in cultivation for upward of 400 years. The variety is figured and notes are given on its history and synonymy.

Effect of grafting (*Country Gent., 64 (1899), No. 2416, p. 388; Nat. Nurseryman, 7 (1899), No. 5, p. 48*).—Reports specific cases of modification of height of plant, color and flavor of fruit, maturity, and adaptation to climate and soil, caused by different stocks.

The pruning book, L. H. BAILEY (*New York: The Macmillan Co., 1898, pp. 530, figs. 331*).—A monograph of the pruning and training of plants as applied to American conditions. This work is one of the Garden Craft Series. The first part of the work on fundamentals considers the rationale of pruning and training; the effect of pruning on the vitality of plants; the fruit bud and its position on the branch in various cultivated fruits; and wounds and their treatment. The principles of pruning are concisely stated in the form of twenty rules after the manner of the author's well-known fifteen rules for plant breeding.

The second part of the book on incidentals treats of the details of American horticultural practice. Specific remarks are made on the pruning of the principal cultivated trees and shrubs. Over one-fifth of the entire work is devoted to American grape training.

The root pruning of transplanted apple trees, N. O. BOOTH (*Gardening, 7 (1899) No. 157, pp. 201, 202*).—A criticism of the Stringfellow root pruning method. From tests made to determine to what length the roots of the apple tree should be cut for transplanting, it is concluded that "the injury caused by too close root pruning is one that the trees do not outgrow, if they do not die outright. The heroic pruning advised by our southern neighbor seems to be ill adapted to our conditions. The mortality among our trees is far too great."

At the end of two years' growth, medium rooted trees were considered quite as desirable as long rooted ones. In an experiment to determine the relative importance of the fibrous and larger roots, most of those transplanted trees from which all of the fibrous roots had been removed died. The percentage of trees that survived transplanting was directly proportional to the number of small roots saved. From an experiment in horizontal root pruning, it is concluded that its advantage, if any, is so slight as not to be overcome by the individual variation of the tree.

Root pruning as frost protection, O. C. BUTTERWICK (*Florida Agr., 26 (1899), No. 18, pp. 280, 281*).—As a result of experiments the author believes that pruning lateral feeding roots is advisable, particularly in damp or very rich soil.

Results of the late freeze in the South, W. F. MASSEY (*Florists' Exchange, 11 (1899), No. 18, p. 485*).

Seedsmen's catalogues, new and old, S. B. DICK (*Florists' Exchange, 11 (1899), No. 21, p. 566, figs. 3*).—Comparative notes on the seed industry in England in 1793 and 1899, based on seedsmen's catalogues of those years.

Forcing fruits and vegetables in France from the industrial and commercial points of view, J. M. BUISSON (*Jour. Soc. Nat. Hort. France, Congrès Hort. 1899, pp. 5-15, dgms. 3*).

Truck farming in Florida (*Florida Agr., 26 (1899), No. 20, p. 312*).—Brief notes on the culture of several vegetables. Celery is not banked but wrapped with Florida moss, giving much better results.

The culture of asparagus, J. F. C. DU PRE (*South Carolina Sta. Bul. 38, pp. 10-15*).—Popular notes. For planting, one-year old roots are preferred to older ones. A commercial grower's statement of his methods of culture is appended.

Forcing green corn under glass, F. W. RANE (*Amer. Gard., 20 (1899), No. 219, p. 163, fig. 1*).—The data of this article are contained in the author's bulletin on the same subject (p. 116).

Raising Bermuda onions (*Jour. Jamaica Agr. Soc., 3 (1899), No. 5, pp. 240-243*)

Cold storage onions (*Pacific Rural Press, 57 (1899), No. 21, p. 321*).—Experiments in California have shown that it is perfectly feasible to overcome the sprouting propensity of the onion by cold storage. The bulbs were kept all winter in fine condition.

Grafting of muskmelon (*Jardin, 1898, Dec. 20, p. 372; Jour. Soc. Nat. Hort. France, 3. ser., 21 (1899), Feb., pp. 112, 113*).—A French experimenter has attempted to graft the muskmelon (*Cucumis melo*) on Cucurbitaceæ, especially of different genera, making use of *Cucurbita perennis*, *Bryonia dioica*, and *Thladiantha dubia*, all of which have perennial, fleshy roots. Grafts on the first species lived and grew, but on the last two have not yet succeeded. The experiments are to be continued.

Cultivation of the vanilla bean in Mexico (*Sci. Amer. Sup., 47 (1899) No. 1221, p. 19580*).—Notes on location, culture, and profits of the business.

Edible mushrooms, H. H. LAMSON (*New Hampshire Sta. Bul. 59, pp. 193-199, figs. 3*).—The author describes in a popular manner the general characteristics of edible mushrooms, and quotes from a publication of this Department directions for guidance in collecting them. He assigns a high food value to mushrooms. (See U. S. Dept. Agr., Farmers' Bulletin 79.)

Michigan fruit list, L. R. TAFT (*Michigan Sta. Bul. 168, pp. 127-139*).—Popular hints are given on selection of trees, care of trees when received from the nursery, planting, and pruning. Lists of varieties of apples, pears, plums, peaches, cherries, grapes, currants, gooseberries, raspberries, blackberries, and strawberries adapted to different sections of the State are suggested for home use and marketing. Notes are given on the peculiar merits of a number of recommended varieties.

Care of orchards, W. M. MUNSON (*Maine Sta. Bul. 49, pp. 8, figs. 2*).—A popular article treating of renovation, grafting, fertilizing, culture, and spraying. A statement is made of the lines of orchard work now in progress at the station. In renovating old orchards that have never been plowed, hogs are recommended for stirring the soil and working in fertilizer.

The treatment of old fruit trees, G. HÖHN and F. K. STOCK (*Kronen-, Stamm- und Wurzelpflege; ein Beitrag zur Behandlung der älteren Obstbäume. Wiesbaden: R. Bechtold & Co., pp. 42, ill.*).—A practical work, treating of pruning, diseases, and fertilizers.

The failure of certain fruit trees to set fruit; its causes and methods of prevention, C. Grosdemange (*Jour. Soc. Nat. Hort. France, Congrès Hort. 1899, pp. 16-27*).—A summary presentation of the subject. The causes considered are frost, rain, fogs, diseases and insect enemies, condition of the soil, exposure, and difference in varieties.

Ben Davis apple, F. A. Waugh (*Gardening, 7 (1899), No. 162, p. 278*).—This variety as grown in New England is much inferior to the same variety as grown in the Mississippi Valley. It is believed that Spy and Fameuse varieties of apples are especially adapted to the Vermont climate.

Origin of the Wealthy apple (*Amer. Gard., 20 (1899), No. 232, p. 404*).

Notes on the banana and its products (*Jour. Jamaica Agr. Soc., 3 (1899), No. 5, pp. 253-256*).—Notes on the culture, yield, and marketing of bananas and the manufacture and chemical composition of banana meal.

California olive industry (*Sci. Amer., 80 (1899), No. 24, p. 389*).—Notes on the history and extent of the industry.

A covered orangery (*Pacific Rural Press, 57 (1899), No. 23, p. 353, fig. 1*).—Notes on an orchard of 17 acres in California covered with lath as a protection against frost. The cost was about $450 per acre.

Curing lemons, A. S. Gaylord (*Pacific Rural Press, 57 (1899), No. 21, p. 324, fig. 1*).

The influence of cold on pear trees (*Garden, 55 (1899), No. 1436, p. 360*).—List of 51 varieties of pears, grouped according to hardiness in France.

Renewing strawberry beds, J. Meehan (*Gardening, 7 (1899), No. 162, p. 279*).—In commercial culture the early removal system is believed to be the most profitable.

Grape culture in the Government of the Black Sea and in the region along the Kuma River, P. Stroyev (*Selsk. Khoz. i Lyesov., 192 (1899), Feb., pp. 331-352*).

Report of the viticultural exposition of São Paulo, 1897, Campos da Paz (*Viticulture; exposition viticole de S. Paul en 1897. Rio de Janeiro: Imprimerie nationale, 1898, pp. 51, pls. 8*).—A statement of the methods of culture employed, varieties planted, and status of the industry in Brazil in 1897.

Lawns, pastures, and hay, P. H. Mell (*Alabama College Sta. Bul. 100, pp. 311-318*).—Directions are given for establishing a good lawn. In the preparation of the land, which is fully described, care should be taken that there is no deficiency in lime. Those grasses should be selected that will best stand the heat of the southern sun and live through the dry season. Notes are given on 5 species and 1 variety of lawn grass well adapted to Alabama soils and climate. These are Bermuda, St. Lucie, carpet, Kentucky blue, and St. Augustine grasses. Late fall seeding is recommended.

Photographing flowers (*Gard. Chron., 3. ser., 25 (1899), No. 649, p. 356*).—Notes taken from the Boston Herald.

Notes on varieties of carnations, C. W. Ward (*Amer. Florist, 14 (1899), No. 565, p. 1066*).—Notes on the merits of 47 varieties by a commercial grower.

The pansy: Its names and its evolution, R. P. Brotherston (*Gard. Chron., 3. ser., 25 (1899), No. 646, pp. 306, 307*).—The etymology of the word itself is discussed and a number of the popular synonyms of the last 150 years are mentioned with bibliographical references. Notes are given on some of the varieties of the early years of this century, the number cultivated and methods of propagation at that time.

The introduction of the fancy pansy, R. Dean (*Gard. Chron., 3. ser., 25 (1899), No. 648, p. 343*).—Extensive historical notes.

Roses for grouping, F. Josst (*Wiener Illus. Gart. Ztg., 23 (1899), No. 5, pp. 147-150*).—Culture of roses for grouping and notes on numerous varieties.

Origin of the Maréchal Niel rose, H. Dauthenay (*Rev. Hort., 71 (1899), No. 10, pp. 223, 224*).

A new method of violet culture (*Amer. Florist, 14 (1899), No. 573, p. 1289, figs. 2*).—The results of experiments by Sonnenschmidt and Junge at Indianapolis, Indiana. The bottoms are chiseled off from 6 in. flower pots, leaving rims 3 in. deep. These are set 1 in. deep in the soil and contain the plants. Marie Louise violets thus treated made a healthier growth, produced more flowers, and made fewer runners than with the usual culture. The plants can be watered without wetting the foliage, thus materially lessening the danger of damping off and overwatering.

Violets trained in tree-like form, H. DAUTHENAY (*Rev. Hort., 71 (1899), No. 6, pp. 142–143, fig. 1*).—A French gardener has produced a new and distinct modification of the violet by separating a stolon from its root and planting and training it to a stake in an upright position. The stems of plants thus trained are long, slender and smooth, and produce very few buds. The terminal bud develops into a cluster of leaves and flowers. Such plants have attained to a height of 50 cm. This height does not depend on the age of the plant but on the length of the stolon when planted. Experience is necessary in order to obtain good results in the use of this method. Thus far but few flowers have been obtained on a single plant. All varieties of violets are not equally amenable to this treatment. The results of this experiment are believed to be rich in suggestion for the culturist, not only of the violet, but also of the strawberry and other stoloniferous plants.

The practical employment of steam at a low pressure for heating greenhouses, A. GUION (*Jour. Soc. Nat. Hort. France, Congrès Hort. 1899, pp. 62–67*).

SEEDS—WEEDS.

Twenty-first annual report of the Swiss Seed-Control Station at Zürich, F. G. STEBLER and E. THIELÉ (*Die Schweizer. Samen-Untersuchungs-Anstalt in Zürich. Einundzwanzigster Jahresbericht, 1898, pp. 35*).—This gives the report of the activity of the station from July 1, 1897, to June 30, 1898, and the administrative report for 1898. During this time 8,462 lots of seed were tested for 525 individuals and firms, the results of the tests being shown in tabular form. Of these, clover and grass seed comprised 76.3 per cent, the remainder being miscellaneous seeds. According to the report, 155 domestic and foreign seed dealers have availed themselves of the privileges of the station in testing and guaranteeing their seed, and, for the most part, the seeds examined were in excess of the guaranty.

The averages of purity, germinative ability, and intrinsic value of all seed tested at the station since 1876 are shown in tabular form. In the following table are shown the data for a number of the more common seeds:

Average results of seed testing in 1876–1899.

Kind of seed.	Number of samples tested.	Purity.	Germinative ability.	Kind of seed.	Number of samples tested.	Purity.	Germinative ability.
		Per ct.	*Per ct.*			*Per ct.*	*Per ct.*
Red clover	10,800	96.4	91	Wood meadow grass	533	80.8	68
White clover	1,457	94.9	79	Yellow oat grass	696	69.3	52
Alsike	1,682	96.0	80	Fiorin	1,006	72.3	83
Alfalfa	4,169	97.1	90	Sweet vernal grass	357	92.4	43
Esparcet	3,740	97.1	76	Velvet grass	601	71.3	49
Crimson clover	145	95.8	89	Reed canary grass	231	88.6	65
Hop clover	369	95.9	78	Seradella	181	95.8	71
Rye grass	4,055	76.9	75	Peas	119	96.4	93
English rye grass	8,656	95.7	81	Vetches	387	91.7	89
Italian rye grass	8,243	94.8	77	Hemp	416	97.8	83
Orchard grass	5,919	78.5	81	Flax	102	97.9	82
Timothy	1,805	98.1	92	Beets	488	97.6	141
Crested dog tail	1,217	90.2	71	Mangels	122	98.5	118
Meadow fox tail	1,757	78.4	62	English fodder beets	213	98.6	90
Tall meadow fescue	2,519	93.0	85	Pine (*Pinus sylvestris*)	3,756	93.1	65
Sheep fescue	1,788	76.1	69	Fir	1,864	95.3	69
Red fescue	223	72.4	57	Larch	1,437	86.6	46
Blue grass	1,824	86.7	61	White pine (*P. strobus*)	300	92.1	58
Rough meadow grass	534	87.2	70	Black pine (*P. nigra*)	427	97.3	66

Plat experiments are reported in which grasses and clovers of different origin were compared. Alfalfa from Utah seed was compared with alfalfa of Italian, Hungarian, and Provence origin, the Italian giving the best showing. It is claimed the American alfalfa was more subject to attacks of *Erysiphe martii* and *Pseudopezizza trifolii* than plants grown from European seed. In other experiments American timothy and orchard grass made the best showing.

Report of the Agricultural Seed-Control Station, Stockholm, for 1897–98, O. Stjernquist (*Redogörelse för Verksamheten vid Stockholms Läns Hushällningssällskaps Frökontrollanstalt 1897–98, pp. 21, figs. 5*).—This gives a report of the activity of the Seed-Control Station of the Agricultural Society of Stockholm for the year ending June 30, 1898. During the year 1,004 analyses were made and 245,443 kg. of seed were certified to. The details of the seed tests are given, and also the averages of the 10-year tests, ending with 1898, of the germination and purity of some 80 varieties of seed. Experiments are reported in which the effect of temperature on the vitality of wheat, rye, barley, and oats was tested. Different lots of seed were subjected to temperatures of dry heat varying from 50 to 90° C. for from 10 to 60 minutes, after which they were germinated with the following results:

Effect of temperature on germination.

Time of heating.	Temperatures.					
	Normal.	50	60	70	80	90
	° C.	° C.	° C.	° C.	° C.	° C.
Ten minutes:						
Wheat	97	100	100	99.5	99	98.5
Rye	99	99	100	99.5	98.5	98.5
Barley	98	98	98.5	97	97.5	96
Oats	81	80	82	86.5	95	96.5
Fifteen minutes:						
Wheat	97	99	100	99.5	99	97
Rye	99	99	99.5	99	98	85
Barley	98	98	97	97	97	95
Oats	81	81	83.5	87.5	97.5	96.5
Thirty minutes:						
Wheat	97	99	99	99	98.5	96
Rye	99	98.5	100	99	98.5	70.5
Barley	98	98	98.5	98	94	52.5
Oats	81	82	86.5	90.5	100	98.5
Forty-five minutes:						
Wheat	97	99.5	100	99	98.5	65
Rye	98	98.5	97.5	98	95	30
Barley	99	99	99	100	99.5	62.5
Oats	81	88	90	98.5	98.5	84
Sixty minutes:						
Wheat	97	99.5	99.5	99	98.5	62
Rye	99	98.5	99.5	99.5	99	60.5
Barley	98	97	98	98	90	12.5
Oats	81	88	97	98.5	98	70

These results are comparable with some figures given for similar experiments made in 1894, in which the seeds were subjected to temperatures ranging from 50 to 99° C. for periods of from 15 minutes to 4 hours.

Illustrated descriptions are given of a number of special forms of apparatus that have been found of superior excellence in seed testing.

Fifth annual report of the Pomological Experiment and Seed-Control Station at Gratz, E. HOLTER (*V. Jahresbericht über die Thätigkeit der Pomologischen Landes-Versuchs- und Samen-Control-Station in Gratz, 1898, pp. 34, figs. 4*).—In addition to the routine report for the year ending June 30, 1898, the report contains brief articles on a number of topics, among them investigations on Lower Styrian varieties of apples, the iron content of apples and pears, the filtration of fruit wine, the manufacture of effervescent wines, ash and other analyses of apples and pears, the composition of Admont turf, the fertilizer value of the municipal compost fertilizers of Gratz, citrate solubility of Thomas slag, and the report of the seed control for the year.

Concerning the duration of the germinative ability of the seed of various cultivated plants, F. TODARO (*Staz. Sper. Agr. Ital., 31 (1898), No. 6, pp. 525–563*).—The tests upon which this paper is based were begun in 1889 by Professor Cugini, and were continued for several years. In 1896 the author took up the work and tested all the available samples to ascertain what effect the age of the seed might have upon its germinative ability. The average viability of commercial seeds was ascertained as a preliminary to the subject. In the following table is shown the vitality of lots of the same samples of seed tested in different years, the data being derived from 506 samples of seed, on which 1,133 tests were made. The figures given are in most cases averages of a number of tests and the species shown are selected from a larger number. The results follow:

Duration of germinative ability of seeds.

Kind of seed.	Average of commercial seed.	1890.	1891	1893.	1894.	1895.	1896.	1897.	1898.
	Per ct.	*P*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
Alfalfa	86.73								
Do		82.38					35.19		
Do			89.67				59.8		
Do				88.53			75.18		
Do							76.5	80.0	83.0
Do							90.5	62.75	81.0
Alsike	78.55								
Do			58.0				1.0		
Do				85.5			53.0		
Do							93.5	75.58	62.5
Do								94.0	65.5
Crimson clover	87.14								
Do		9.0					0.		
Do			81.5				21.75		
Do				[a] 97.7			1.0		
Do				90.25			19.04		
Do					92.5		73.62		
Do						93.0	86.5		
Do						93.0	92.5	90.0	74.0
Red clover	92.59								
Do			91.83				2.58		
Do				81.62			19.61		
Do					89.93		82.83		
Do						93.03	87.53		
Do						93.5	97.0	84.25	
Do						89.5	93.5	87.5	
Do						92.25	96.0	86.5	
Do						78.75	97.25	96.5	
White clover	80.95								
Do		72.5					5.5		
Do					76.0		25.25		

[a] This test was made in 1892.

Duration of germinative ability of seeds—Continued.

Kind of seed	Average of commercial seed	1890	1891	1893	1894	1895	1896	1897	1898
	Per ct	*Per ct*	*Per ct*	*Per ct*	*Per ct*	*Per ct*	*Per ct*	*Per ct*	*Per c*
White clover					77.5		69.33		
Do					78.5		71.0	71.5	61.0
Do						79.22	71.49	...	
Do						90.5	58.83	37.5	
Do						79.0	78.16	84.0	75.5
Do							64.07	63.0	61.0
Creeping bent grass	74.15								
Do			27.0				0		
Do					87.0		53.5		38.0
Tall oat grass	66.13								
Do				71.0			29.5		7.0
Do					46.0		32.0	..	
Orchard grass	62.43								
Do				56.35			40.0		28.0
Do								88.0	74.5
Meadow fescue	84.67								
Do			73.5				0		
Do				83.04			28.2		
Do				90.03			34.0		2.0
Do				5.0			0		
Do				93.5			0.5		
Italian rye grass	69.54								
Do			49.5				49.0		
Do			44.5				19.0		.
Do			83.0				53.5		
Do				65.17			44.83		
Do					73.0		79.5		.
Do					86.0		72.0		..
Do						63.5	67.67		
Do							92.5		78.5
Perennial rye grass	70.87								
Do		23.5					0		
Do					67.5		36.0		
Do							89.0	84.0	57.5
Do							92.5		77.0
Timothy	91.83								
Do			95.5				0		
Do				88.5			2.0		
Do					72.5		16		
Do							97.0	81.5	
Blue grass	36.5								
Do			47.0				0		
Do					27.0		4.7		
Do							42.0		33.0
Do							76.5	63.5	
Rough stalked meadow grass	63.12								
Do					31.5		17.0		
Do							87.0	70.0	
Oats						[illegible]	[illegible]		98.0
Barley					87.0				57.5
Wheat	92.34					91.48	97.39		93.15
Do							96.73		94.5
Onions		91.5	71.0				0		
Hemp	53.32								
Do				80.0			26.3	1.0	
Do					[illegible]		53.5	34.0	12.5
Do						5.9	21.64		
Do						9.0	60.0	32.5	4.5
Do							79.0	67.0	30.5
Beet	81.33								
Do				85.0			72.5	90.0	83.0
Do					87.27		77.33	79.17	
Do					88.8	87.5	84.5	74.0	74.0
Do						90.75	87.25		
Do							80.92	80.83	

Nevada weeds. III, Nevada and other weed seeds, F. H. HILLMAN (*Nevada Sta. Bul. 38, pp. 131, figs. 12*).—Believing that comparative immunity from many of our worst weeds may be secured by preventing the sowing and subsequent tillage of their seeds along with those of more desirable plants, the author has given a study of more than 150 species of weed seeds. The most of these are figured in their natural size, and are also shown in enlarged form. The descriptions given are as untechnical as the nature of the subject will admit. In the introduction a discussion is given of seed in its popular sense, methods of distinguishing various kinds, and notes on distribution of weed seeds and the desirability of and the methods for examination of commercial seeds to determine the presence and character of weed seeds.

On the destruction of the oxeye daisy, F. W. RANE (*New Hampshire Sta. Bul. 59, pp. 176–178, fig. 1*).—During a period of several years the author has been endeavoring to overcome this pest. One method adopted was to cut the hay early and thus avoid the maturing of the seed. In order to ascertain how elastic this period might be, a number of heads of daisies were collected for study, and the results of the germination of the seeds are shown in tabular form. It appears that it takes at least 12 days for seed maturity of the daisy after it first blossoms, and by repeatedly cutting the weed before or during this period its extermination could be secured.

Report of the seed-control station of the Imperial Botanic Gardens, St. Petersburg, J. KLINGE (*St. Petersburg, 1898, pp. 10*).—A summary is given of the results of 20 years' work.

On the influence of the size of seed on germination, H. J. J. VANDEVELDE (*Bot. Jaarb. Kruid. Genotsch. Dodonæa, Ghent, 10 (1899), p. 109, pls. 6, figs. 2*).

Spraying wild mustard (*Hoard's Dairyman, 30 (1899), No. 16, p. 315*).—Notes on experiments in Great Britain and elsewhere in which spraying with strong solutions of iron sulphate successfully destroyed wild mustard.

On the destruction of Orobanche on clovers, A. LONAY (*Jour. Soc. Agr. Brabant-Hainaut, 1898, No. 38*).

Cuscuta monogyna on the grape, P. VIALA and G. BOYER (*Ann. École Nat. Agr. Montpellier, 10 (1897–98), pp. 279–304, pl. 1, figs. 32*).—A botanical study of this parasite of the grapevine. The seeds are said to retain their vitality for 2 or 3 years in the soil, and by care the plant can be exterminated from a vineyard in that time.

DISEASES OF PLANTS.

The asparagus rust in Massachusetts, G. E. STONE and R. E. SMITH (*Massachusetts Hatch Sta. Bul. 61, pp. 20, pls. 2*).—The authors briefly review the history of the introduction of asparagus into the State, and show by statistics the present extent of asparagus growing for market. The rust of asparagus (*Puccinia asparagi*) is said to have made its first conspicuous appearance in the summer of 1896, but there was no perceptible damage to the market crop of 1897 as a result of the rust occurring in the year previous. During the latter part of the season of 1897 the uredo form of the rust appeared in considerable abundance and caused serious injury to the asparagus crop.

The life history of the rust is given, the different stages being described separately. The authors believe the earlier stages of the rust may possibly be omitted. In 1897 the teleutospores were borne in very great abundance, and they apparently failed to affect the plant in the spring of 1898, so that neither the æcidial or uredo forms appeared in 1898. It is thought probable that the teleutospores which failed to affect the plants in the spring retained their vitality until late in the summer, when they produced the fall stage of the rust. It is thought possible, also, that the fungus may remain alive over the winter in the plant tissues, not producing spores again until autumn.

The economic importance of asparagus makes this disease a serious one, and estimates made at various places concerning the amount of asparagus cut in 1898 show that there was a depreciation of from 15 to 80 per cent, the average loss experienced being 20 to 25 per cent.

The cause of the severe outbreak of the asparagus rust is said to be probably due to conditions of the plant brought about by the excessive drought during 1895–96, followed by the excessive rains of 1897. The effect of the rust upon plants grown in different soils is noted, it being much more injurious on soils which are dry and sandy, having little water-holding capacity; where the soils were heavier and retained water to a greater extent the rust has caused no appreciable harm.

Comments are made upon the methods of controlling the rust, from which it appears that burning the affected tops and spraying with fungicides, such as potassium permanganate, Bordeaux mixture, and potassium sulphid, are of little or no avail. Cultivation and irrigation as means of controlling the rust are believed to be more efficient, and it is stated that in this manner vigorous plants may be secured which will resist the attacks of the disease.

From the knowledge of the occurrence of the rust in Europe and from observations made throughout the State, the authors believe that the outbreak of the asparagus rust is of a sporadic nature and not liable to cause much harm in the future provided attention is given to the production of vigorous plants.

The asparagus rust in South Carolina, A. P. ANDERSON (*South Carolina Sta. Bul. 38, pp. 1–10, figs. 5*).—The author reports the occurrence of the asparagus rust (*Puccinia asparagi*) at numerous places in South Carolina. According to one grower its presence has been noted since 1895, and in his experience it seems to vary but little in its attacks upon different varieties. The cause of the disease is described and suggestions made for its treatment. In addition to spraying with fungicides and burning, which are frequently recommended, it is suggested that heaping up the beds to destroy the spores and sprinkling the soils with lime or land plaster might prove beneficial.

Some diseases of wheat and oats, A. D. SELBY (*Ohio Sta. Bul. 97, pp. 31–43, figs. 4*).—On account of the prevalence of diseases in the vicinity of the station, considerable study has been made and experiments conducted relative to the nature and methods of prevention. In the region mentioned the smuts and rusts of wheat are said to be the more prevalent and destructive fungus diseases, while the scab, glume spots, and other parasitic diseases usually take a minor rank.

The cause and nature of the loose smut and the stinking smut of wheat are described at some length. The life history of the loose smut (*Ustilago tritici*) is given in some detail, and it is said to cause yearly losses amounting to nearly $100,000 within the State. Different varieties of wheat vary in their susceptibility to the disease, and by care in seed treatment it may be prevented. Seed free from smut being once secured may usually be employed for several years without further treatment.

The stinking smut of wheat is said to be due to two species of fungus (*Tilletia tritici* and *T. fœtens*) which are described in some detail. The statement made in Michigan Station Bulletin 87 (E. S. R., 4, p. 352) that these two species of stinking smut, which can only be separated by a microscopic investigation, produce different kinds of diseases, known as high and low smut, was investigated without discovering any constant difference. It is probable, however, that only one of the stinking smuts is common in the vicinity of the station. Recent experiments with copper sulphate and hot water have shown the practicability of holding in check this disease, which is said to cause a loss amounting to $250,000 per year.

While it is generally believed that smutted seed is the usual source of infection, it is sometimes claimed that land which has grown a smutted crop will afford conditions necessary to infest a subsequent crop. An investigation of this subject was made in which plats of untreated grain from the crops of 1894 and 1895 as well as treated grain from both these years were sown alongside one another with the result that no direct infection could be ascertained through means of the soil. It is also stated that the claim sometimes made that old seed may be sown without danger of smut is incorrect, an experiment being cited in which spores germinated after having been kept 8½ years in a herbarium.

The rusts of wheat are described at some length and considerable quotations given from Eriksson's publications relating to these diseases (E. S. R., 10, p. 316).

The wheat scab, which usually causes but little injury to the crop, may at times and upon different varieties seriously interfere with the crop production, losses of 10 per cent or more being not unusual. This disease, which is due to the fungus *Fusarium roseum*, is described. The fungus is said to be of the conidial form of *Gibberella saubinettii*, and experiments conducted by the author seem to justify this conclusion, although they do not fully prove it. The means of prevention of scab suggested are the burning of stubble when wheat is to follow a scabby crop.

A disease of wheat is described under the name of glume spot, in which dark spots become very conspicuous upon the glumes of certain varieties such as Velvet Chaff. The fungus appears to be referable to Septoria.

Experiments in the prevention of grain smuts and the treatment of unsmutted wheat seed, J. F. HICKMAN and A. D. SELBY (*Ohio Sta. Bul. 97, pp. 43-61*).—This gives the results of experiments conducted by the authors during 3 years subsequent to 1895. In the treatments for prevention of wheat diseases, water heated to various temperatures, copper sulphate, and potassium sulphid were compared. The efficiency of hot water and copper sulphate treatments was plainly shown. The effect of seed treatment upon smut-free grain was tested, with no apparent increase on the treated plats.

Further experiments on the prevention of oat smut (E. S. R., 8, p. 238) are reported. The efficiency of hot-water treatment and the relative efficiency of Ceres pulver and potassium sulphid, effect of shortening the time of immersion in hot water, and the use of formalin were tested. The results of the different tests are tabulated, from which it appears that there was little difference between 10 and 15 minutes' immersion of seed in hot water; the Ceres pulver and potassium sulphid treatments were less efficient than the others, and 5 minutes' soaking in water heated from 140 to 144° F. gave practically the same results as have been previously secured by treating the seed for 10 minutes at 133°. In conclusion the authors state that much, if not all, the loss occasioned by the diseases of wheat and oats may be prevented by the proper treatment of seed prior to sowing, and give directions for the different forms of treatment recommended.

Three important fungus diseases of the sugar beet, B. M. DUGGAR (*New York Cornell Sta. Bul. 163, pp. 337-363, figs. 15*).—On account of the recent interest in the production of sugar beets, attention has been directed to some of the diseases to which this crop is liable, and the author has made careful investigations of three which are more or less prevalent.

The root rot of beets (*Rhizoctonia betæ*) was first noticed early in 1898, and a few days later was found abundant at a second station. A visit to the latter place in August demonstrated that the disease was a matter of considerable practical importance, an examination of the field showing that probably one-third of the beets were affected. The first evidence of an attack is manifested in the blackening of the bases of the petioles, the outer leaves first, so that the stalks soon become unable to support the blades and the leaves fall to the ground. The disease soon attacks the crown and root proper, causing the infested parts to turn brown. If the conditions continue favorable for the disease, the whole top rots away and the beet gradually disappears. Ordinarily the trouble is carried throughout the entire field, but numerous small areas indicate that the fungus passes rapidly from plant to plant in a row.

The cause of this root rot of beets is due to the fungus Rhizoctonia, as was demonstrated by a series of inoculation experiments. In these experiments it was shown that the fungus readily produces root rot where the conditions are favorable, and that moist conditions are essential for the spread of the disease from plant to plant. The special characteristics of the fungus are described at some length and attention is called to the probable fact that the fungus causing this beet disease is also a cause of other types of plant disease. Among those mentioned as probably due to this same fungus are the sore shin of cotton, the damping off of lettuce, cabbage, radish, eggplant, etc., and probably a stem rot of carnations.

As a remedy for the prevention of this disease, it is recommended that 60 to 70 bu. of air-slaked lime per acre be applied to the soil in the autumn or at least before the ground is turned so that the lime could be well distributed.

The leaf spot of the beet (*Cercospora beticola*) is a disease of very wide distribution. It attacks not only the sugar beet but many of the garden varieties as well. Its occurrence may be noted by the appearance of small brown spots with reddish purple margins scattered irregularly over the leaves. The spots become ashen gray at the centers with the border as before, and they may become so numerous as to cover a large portion of the surface of the leaf. As the leaves begin to appear parched and dry they assume a nearly upright position and a badly infested field presents a very characteristic appearance.

The technical characters of the fungus are described, and as remedies the author states that Bordeaux mixture has proved most efficient. It is believed that by beginning the sprayings early, the leaf spot may be almost entirely prevented by the use of this fungicide. The theory that this disease may possibly be distributed through the medium of the seed is briefly considered, and as having a bearing upon this subject all seeds were treated before planting with hot water and copper sulphate solutions to test their effect upon the germination. In general, even a strong solution of copper sulphate gave slightly better results than where the seed was soaked in water. This may have been due, however, to the exclusion of bacteria by the copper solution.

The beet scab (*Oöspora scabies*) is figured and described. This disease is well known on account of its occurrence on potatoes and beets. The only remedial treatment is to avoid growing beets in any soil which for several years previous has produced scabby potatoes or beets. The bulletin concludes with a list of references to literature of beet diseases.

The root rot of sugar beets, J. STOKLASA (*Centbl. Bakt. u. Par., 2. Abt., 4 (1898), No. 17–18, pp. 687–691, figs. 2; abs. in Ztschr. Pflanzenkrank, 9 (1899), No. 1, pp. 50–51*).—*Pythium debaryanum*, *Phoma betæ*, and *Rhizoctonia violacea* were found in greater or less abundance in the tissues of all diseased beet seedlings. All varieties are not equally susceptible to these attacks, and it was found that soaking the beet seed in a weak solution of corrosive sublimate prior to sowing was efficient in preventing the disease to a great extent. By the nature of the seed bolls they are liable to be infested by a number of organisms such as bacteria, etc., which attack the albuminoids in the young plant, greatly weakening it.

A contribution to the knowledge of fruit rots, J. BEHRENS (*Centbl. Bakt. u. Par., 2. Abt., 4 (1898), Nos. 12, pp. 514-522; 13, pp. 547-553; 14, pp. 577-585; 15-16, pp. 635-644; 17-18, pp. 700-706; 19, pp. 739-716; 20, pp. 770-777*).—An extended study has been made of the fruit rots. The author states that *Penicillium glaucum* causes the rot of the fruit of apples, pears, grapes, and the outer shell of the walnut; *P. luteum* of apple; *Mucor stolonifer* of pears and tomatoes; *Botrytis vulgaris* of apples, pears, strawberries, currants, grapes, and walnuts, and *Oidium fructigenum* on apples, pears, plums, cherries, apricots, peaches, quinces, etc. The physiology of each fungus, the specialization of the different fungi, the changes in the fruit subsequent to the attack, and the susceptibility of the fungi to copper compounds are reported upon at length.

The form of injury produced by each of these fungi is described, and means suggested for the prevention of their attacks. In addition to attacking the fruit, *Botrytis vulgaris* was found to attack other parts of the plant, and the author claims it produces a poison which is destructive of the living protoplasm of the cell.

Peach-leaf curl and notes on the shot-hole effect of peaches and plums, B. M. DUGGAR (*New York Cornell Sta. Bul. 164, pp. 369-388, figs. 9*).—The peach-leaf curl (*Exoascus deformans*) was technically described in Bulletin 73 of this station (E. S. R., 6, p. 554) and in the present discussion only a general account of the life history of the fungus is included. The appearance of the disease, life history of the fungus, conditions affecting the abundance of leaf curl, and remedies are discussed at some length. The sporadic occurrence of the leaf curl is said to be rather remarkable. In many sections of the State there was but little of the disease in 1896 while in the same sections in 1897 there was an abundance of it, and in 1898 these regions were characterized by unusual injuries from this cause. Numerous attempts have been made specifically to define the conditions which encourage this disease, but sufficient is not yet known of the life history to warrant positive statements regarding them. Different varieties vary greatly in the degree of susceptibility to attacks of leaf curl. The earlier experiments made to determine the value of fungicides for prevention of leaf curl were unsatisfactory, for the fungicides themselves often injured the leaves, and also the best time for spraying was not known.

In 1896 an orchard of young trees was affected with leaf curl, and the following year the disease was so abundant as to cause almost entire defoliation, and there was every promise of an abundant reappearance of the disease in 1898. Spraying experiments with Bordeaux mixture, potassium sulphate, and ammoniacal copper carbonate were conducted in which applications were made at different periods. The results seemed to indicate that where Bordeaux mixture was used before the buds swelled, the foliage of the tree was very largely free from curl. It also appears that treatments subsequent to the early treatment of Bordeaux are very insignificant in preventing the disease, and that the early treatment is the one of importance for the protection of the foliage during the season. An experiment is reported in which winter applications of milk and lime, and lime and dextrin were made to 12 trees in the center of a block of about 4,000 trees. All the trees were considerably affected with leaf curl with the exception of the treated ones, which were almost absolutely free from it. In spraying for the prevention of this disease care must be taken, since fungicides are very liable to injure the foliage, and a weak Bordeaux mixture would probably give the best results.

Leaves of the plum and peach have been frequently noticed in which the shot-hole effect was very apparent even where the trees had been abundantly sprayed. The author's attention was called in 1897 to the abundance of the shot-hole effect on Japan plums which had been frequently sprayed, and the indications were that the injuries to the foliage were due to the chemical agents applied. In general, peaches, apricots, and plums of the native and domestica groups were free from this effect, but Japan plums generally indicated some injury. Experiments made with properly prepared Bordeaux mixture produced no injury whatever except on the Japan plum (Burbank), while improperly prepared Bordeaux mixture affected the peach and Japan plums to a marked extent. Careful examination of the leaves of these trees showed no indication of fungus, and it must be attributed to the improper application of the fungicides. The author states that after examining a number of plum orchards, he finds the Japan plums so free from shot-hole fungi that there is no necessity for spraying them for protection against this disease. Where the plum rot is bad, it would be necessary to spray, and it will be necessary to disregard the slight injury to foliage resulting from the use of properly made Bordeaux mixture.

Treatment of mildew on grapevines, G. B. MALLETT (*Gard. Chron., 3. ser., 25 (1899), No. 648, pp. 354, 355*).—The author reports the successful use of hot water for the destruction of grape mildew. In 1898 unsuccessful attempts were made to stamp out the mildew from vineries by the use of potassium sulphid and by dusting the vines with sulphur, etc., but the crop of that season was a total failure. Early in 1899 the vineries were thoroughly cleaned, new soil replaced in borders and walks, and the canes of the vines were painted with a strong mixture of sulphur and potassium sulphid with but little effect, as the mildew appeared in several places by the time the vines had reached the flowering stage. Acting upon a suggestion, the author thoroughly sprayed the vines with water heated to the boiling point, which was carried a distance of some 60 yards and quickly sprayed over the leaves. The vines were thoroughly soaked on two separate occasions, and special investigations showed not a trace of living mildew, but brown spots on the leaves were plentiful. These leaves were removed and no trace of the fungus has since been observed. There was no injury observed to leaf or flower, nor were the tender growing tips injured, although adventitious roots on some of the canes were blackened.

Subsequently vines of the White Tokay were sprayed with water as near the boiling point as possible, and a few days later a second application of the same kind was given, the vines coming through uninjured. In all, 4 varieties of grapes have been experimented upon in this way, and in every case the vines are said to be growing freely and the berries are unharmed.

In a subsequent issue (No. 650, p. 388) the experience of several others with hot water upon living plants is given. In one instance the writer had dipped plants, without injury to them, into water heated to 170° F. to rid them of mealy bugs. In another case the writer reports having sprayed grapevines with water in the method described above with identically similar results.

A copper fungicide containing permanganate of potash, C. TROUCHOT (*Prog. Agr. et Vit. [Ed. L'Est], 20 (1899), No. 8, pp. 211-213*).—The author describes the use and gives the formula for a fungicide which it is stated has been very successfully employed for the prevention of black rot of grapes. The fungicide is composed of copper sulphate 1.5 kg., copper carbonate 2.5 kg., and water 100 liters. This should give a slightly alkaline reaction, and to it is added 25 gms. permanganate of potash, dissolved in a liter of water. On account of the presence of permanganate of potash the author has given the name to the fungicide of "violet mixture." Its action is said to be equal to that of Bordeaux mixture, and in addition it is claimed to adhere to the foliage better.

A study of the fungus parasites of the cultivated Rosaceæ, E. OUVRAY (*Jour. Soc. Nat. Hort. France, Congrès Hort. 1899, pp. 47-61*).—The author briefly describes the fungi which attack the cherry, plum, peach, apricot, almond, apple, pear, quince, medlar, service tree, hawthorn, strawberry, raspberry, and rose. Suggestions are also given for combating the fungi, and great stress is laid upon the value of winter treatments and the more extensive use of iron sulphate solutions is suggested.

Botanical, chemical, and toxicological properties of fungus-infested grass seeds, J. HOCKHAUF (*Verhandl. K. K. Zool. Bot. Gesell. Wien, 19 (1899), No. 2-3, pp. 120-123*).—A brief summary is given of the different fungi known to exist in the grain of cereals, etc., with notes on their chemical and toxicological properties.

Concerning the attack of Phoma betæ upon beets, FRANK (*Ztschr. Ver. Deut. Zuckerind., 48 (1899), No. 511, pp. 711-717*).

Cacao pod disease, J. H. HART (*Bul. Bot. Dept. Trinidad, 3 (1899), No. 11, pp. 167, 168*).—A note is given of a fungus, probably one of the Peronosporeæ, that attacks cacao pods and causes some loss. The disease seems widespread but poorly understood, and for the present it is advised that diseased pods be destroyed and badly affected trees sprayed with copper sulphate solutions. It is stated that Bordeaux mixture, unless very dilute, injures foliage in hot climates.

Diseases of coffee, J. B. POMPEU (*Bol. Inst. Agr. São Paulo, 9 (1898), No. 3, pp. 329, 330*).

Leaf blight of currants, J. E. WEISS (*Prakt. Bl. Pflanzenschutz, 2 (1899), No. 3, p. 22*).—Notes are given on *Glœosporium ribis*.

Studies of black rot of grapes, L. RAVAZ and A. BONNET (*Ann. École Nat. Agr. Montpellier, 10 (1897–98), pp. 90–102, pls. 2*).—A report is given of studies on the life history of the black-rot fungus, the germination of the spores, penetration of the tissues, development of the mycelium in the tissues, and the period of incubation being reported upon. Concerning the latter, it is said to be rarely less than 10 or 11 days between the sowing of the spores and the appearance of the disease.

A disease of hops, P. NYPELS (*Ann. Soc. Belge Micros., 23 (1899), pp. 34–39, pl. 1*).—A brief description of a hop disease of uncertain origin is given.

Peach diseases, H. N. STARNES (*Georgia Sta. Bul. 42, pp. 220–225, figs. 3*).—Of the diseases popularly described those due to undetermined causes are peach yellows, peach rosette, gummosis, and crown gall. Of the fungus diseases, peach rot, scab, pustular spot, leaf curl, and peach rust are given, and suggestions offered for their control.

Injurious diseases of pear trees, J. E. WEISS (*Prakt. Bl. Pflanzenschutz, 2 (1899), No. 2, pp. 9–11, figs. 4*).

The peony disease, G. MASSEE (*Gard. Chron., 3. ser., 25 (1899), No. 649, p. 351*).—A destructive disease, due to *Sclerotinia pæonia*, is briefly described. The disease begins on the leaf stalk an inch or less below the surface of the ground. The first symptoms are the curling of the edges of the leaves. All such leaves should be removed at once and the plants sprayed at intervals of 4 days with ammoniacal copper carbonate. The fungus is said not to be perennial in the tissues of the host. Where the disease has existed for some time the soil around the crown of the plant should be removed and fresh soil mixed with quicklime put in its place.

A disease of phlox, P. NYPELS (*Ann. Soc. Belge Micros., 23 (1899), pp. 9–32, pl. 1*).—Describes a disease of phlox, which is said to be due to *Tylenchus devastatrix*. A list of 45 species of plants known to be attacked by this pest is appended.

Concerning a living fluid contagium as a cause of the mosaic disease of tobacco, M. W. BEIJERINCK (*Seperat. Verhandl. K. Akad. Wetensch. Amsterdam, 1898; abs. in Bot. Centbl., 78 (1899), No. 5, pp. 146–151*).—It is claimed that the cause of the mosaic disease of tobacco leaves is due to what is termed a living fluid contagium. The author claims to be able to isolate the poison and to induce disease with it by inoculation. It is also claimed that peach yellows and peach rosette may be due to the same cause.

Concerning the Æcidia occurring upon the Umbeliferæ, H. O. JUEL (*Ofvers. K. Svenska Vetensk. Akad. Förhandl., 1899, No. 1, pp. 5–20, figs. 4*).

Studies on plant galls, O. APPEL (*Ueber Phyto- und Zoomorphosen. Sepabdr. Schr. Phys. Oekon. Gesell. Königsberg, 39 (1899), pp. 58*).

Bacterial excrescences on Juniperus phœnicea, F. CAVARA (*Bul. Soc. Bot. Ital., 1898, No. 8, pp. 241–250*).

Plant diseases due to nematodes, T. PETERSEN (*Natur, 49 (1899), No. 2, pp. 19, 20*).

Winter treatment for plant diseases, J. E. WEISS (*Prakt. Bl. Pflanzenschutz, 2 (1899), No. 3, pp. 19–22*).

Combating mildews, NESSLER (*Wchnbl. Landw. Ver. Baden, 1899, No. 3, pp. 26, 27*).—Notes on Oidium.

Apple spraying in Nova Scotia, C. H. HOOPER (*Gard. Chron., 3. ser., 25 (1899), No. 650, pp. 373, 374*).—Notes are given on the successful use of potash solutions for clearing trees of moss and lichens, and on spraying with Paris green, copper sulphate, and Bordeaux mixture for the control of insects and fungi on apples.

Notes on experimental spraying, W. M. ORR (*Fruit Growers' Assoc. Ontario Rpt. 1898, pp. 69–77*).—Gives a detailed report of the experiments in spraying 30 apple orchards in 1898 The orchards were in many cases widely separated, and upon nearly every variety the results were decidedly in favor of the treatment. Bordeaux mixture, to which 4 oz. of Paris green to 40 gal. of water was added, was the fungicide used.

Sulphuring grapes, H. DAUTHENAY (*Rev. Hort., 71 (1899), No. 9, pp. 207, 208*).—The author claims that sulphur applied to grapevines in the sun is more efficient than upon shaded vines or during cloudy weather.

Concerning the value of Bordeaux mixture in preventing potato diseases and in increasing the crop (*Fühling's Landw. Ztg., 48 (1899), Nos. 4, pp. 142–148; 5, pp. 166–169*).

The effect of ethereal oils on fungi, T. BOKORNY (*Arch. Physiol. [Pflüger], 73 (1898), pp. 555–594; abs. in Bot. Centbl., 78 (1899), No. 5, pp. 133–136*).—The ethereal oils are reported as quite poisonous to fungi, oil of turpentine being antiseptic when used in the proportion of 1 : 50,000.

A new fungicide of great adhesiveness, J. F. FAVARD (*Rev. Hort., 71 (1899), No. 4, pp. 87, 88*).—A solution of copper sulphate, sodium carbonate, and water, to which resin is added, is described.

Investigations on the adherence of copper fungicides and the causes for variation in fungicides as formerly prepared, J. M. GUILLON and G. GOUIRAND (*Rev. Vit., 1898, No. 265, pp. 29–32*).

ENTOMOLOGY.

The economic status of insects as a class, L. O. HOWARD (*Science, n. ser., 9 (1899), No. 216, pp. 233–247*).—In an address as retiring president of the Biological Society of Washington the author reviewed the economic status of insects, dividing them into two groups, as follows: (1) Injurious insects—those which destroy crops and other valuable plant life; those destroying stored foods, dwellings, clothes, books, etc.; those injuring live stock and other useful animals; those annoying to man, and those acting as carriers of disease; and (2) beneficial insects—those which destroy injurious insects, destroyers of noxious plants, pollenizers of plants, scavengers, makers of soil, and those which serve as food for poultry, birds, fishes, etc. The beneficial insects are said to embrace 113 families, and the injurious 116 families, while those belonging to both classes or undetermined represent 71 families.

Report of consulting entomologist, R. S. MACDOUGALL (*Trans Roy. Scot. Arbor. Soc., 15 (1898), pt. 3, pp. 307–316*).—The author gives notes on *Goës tigrina*, which occurred in oak timber shipped to Great Britain from the United States. Economic and biological notes are given on the small brown pine weevil (*Pissodes notatus*). The insects are said to lay eggs for two seasons. The egg laying takes place from April until September. As a preventive measure against this beetle the author recommends allowing sickly or diseased trees to stand as places for the insects to deposit their eggs. These trees may then be destroyed.

A description and the life history of the *Sirex gigas* is given. Concerning *S. juvencus* the author relates the life history at considerable length. An ichneumon fly (*Rhyssa persuasoria*) was seen depositing its eggs in bark which contained the larvæ of sirex. As a remedy against this species the author suggests burning the felled trees and waste timber in infested forest areas.

The pear midge (*Diplosis pyrivora*) is reported as increasing in numbers and harmfulness in Great Britain. Notes are given by way of description of the appearance and habits of the insect, and the usual remedies are recommended.

The insect record for 1898, C. M. WEED (*New Hampshire Sta. Bul. 59, pp. 199–215, figs. 12*).—The author gives notes on the life history and damages resulting from the work of the forest tent caterpillar (*Clisiocampa disstria*) and the American tent caterpillar (*C. americana*). In the case of the latter insect, an efficient method of destroying the larvæ while in the tent was found to be the application of a small quantity of kerosene, being careful not to saturate the bark of the twigs. In one town in the State the school children were offered 10 cts. per hundred for the egg masses; 8,250 egg masses were collected at an expense of $8.25, which would seem an effective means of reducing the number of these caterpillars.

The antiopa butterfly (*Vanessa antiopa*) is reported as feeding in colonies on the elm trees and defoliating large branches. It is recommended that the branches infested with the caterpillars be cut off and the caterpillars crushed.

The fall webworm (*Hyphantria cunea*) was especially prevalent during the year. The branches upon which this larvæ are feeding should be removed from the tree and the larvæ crushed or burned. *Edema albifrons* caused considerable destruction to the leaves of various species of oak. The caterpillars were preyed upon extensively by the common ruffed grouse. Popular notes are given on the cecropia moth and on the luna moth.

The rose beetle (*Macrodactylus subspinosus*) committed depredations on young hydrangea shrubs. The most effective means of combating these insects seemed to be brushing them into a pail or pan containing water with a film of kerosene upon it.

Some experiments were made with regard to remedies for the cabbage worm (*Pieris rapæ*). One family is said to have been made ill by eating cabbage which had been sprayed with Paris green. Pyrethrum applied dry, either undiluted or thoroughly mixed with an equal quantity of flour, or applied as a decoction in the proportion of 1 oz. of pyrethrum to 1 gal. of boiling water, proved to be an efficient remedy and not dangerous to man.

The bean weevil (*Bruchus obtectus*) is said to have been especially injurious during the year. As a remedy it is recommended that the beans be inclosed in a tight vessel and fumigated with bisulphid of carbon.

Some pests likely to be disseminated from nurseries. The nursery inspection laws, H. GARMAN (*Kentucky Sta. Bul. 80, pp. 201–273, figs. 9*).—This bulletin contains a general account of spraying machinery and directions for making the standard insecticides. The author discusses a number of insects and fungus diseases which are likely to be introduced upon nursery stock and which are to be guarded against. Brief descriptions with recommendations as to the kind of treatment to be applied are given in each case.

The insects mentioned as especially injurious are: San José scale, woolly aphis, oyster-shell bark-louse, scurfy bark-louse, apple aphis, apple-leaf skeletonizer (*Canarsia hammondi*), apple-leaf crumpler (*Mineola indiginella*), apple-tree tent caterpillar, white-marked tussock moth, bagworm, cherry-tree aphis, black peach aphis, pear-leaf blister mite, and strawberry crown borer.

Of injurious fungus diseases the author mentions the following: Apple scab, apple-leaf rust, cherry leaf spot, currant-leaf spot, grape mildew, peach rosette, peach yellows, peach-fruit spot, pear blight, black knot, quince-leaf spot, raspberry anthracnose, and strawberry-leaf blight.

The law of Kentucky regarding inspection of nursery stock is reprinted, as well as forms of the various certificates.

Butterflies and moths injurious to our fruit-producing plants, O. LUGGER (*Minnesota Sta. Bul. 61, pp. 53-331, figs. 237, pls. 24*).—In the first 10 pages of the bulletin the author gives a brief account of the general and special anatomy of butterflies and moths, together with some details as to their classification, habits, life history, and metamorphosis. The remaining portion of the bulletin is occupied with economic and biological notes on about 170 species of butterflies and moths. The most of these species are figured, some in all their stages. The life history and the methods of artificial treatment which are most approved are mentioned in each case.

The bulletin constitutes a quite complete compendium of information on the subject of the common butterflies and moths which are known to attack fruit trees and fruit plants. An index is appended.

Two destructive orchard insects, V. H. LOWE (*New York State Sta. Bul. 152, pp. 277-301, pls. 3*).—*The apple-tree tent caterpillar*, pp. 277-297).—The bulletin contains a resume of the history of our knowledge concerning the apple-tree tent caterpillar, together with suggestions regarding its means of distribution, a list of its food plants, and technical descriptions of the egg, caterpillar, and adult. The caterpillars are said to molt 5 or, exceptionally, 6 times. Descriptions are given of the tent and the method and place of pupation.

Among the natural checks the author mentions cold weather and rain storms while the larvæ are just hatching, and a considerable number of species of birds were observed to feed upon them. Among predacious insects the author records *Calosoma scrutator*, *C. calidum*, and *Podisus spinosus*. Of the parasitic insects, *Telenomus clisiocampæ* attacks the eggs of the tent caterpillar, and the following species prey upon the larvæ: *Pimpla conquisitor*, *P. pedalis*, *P. annulipes*, *Theronia fulvescens*, *T. melanocephala*, *Spilocryptus* (*Cryptus*) *extrematis*, *Dibrachys baucheanus*, *Apanteles congregatus* var. *rufocoxalis*, and *Frontina frenchii*.

A bacterial disease is reported as having been especially prevalent during warm moist weather and to have destroyed numbers of the caterpillars. The author recommends the destruction of wild cherry trees and neglected apple trees and brush such as are fed upon by the caterpillars. Collecting the egg masses is also to be encouraged, and the caterpillars may be destroyed by spraying with arsenical poisons. Green arsenite at the rate of 1 lb. to 150 gal. of water was applied 3 times. The second application was usually sufficient to destroy nearly all the caterpillars. The arsenite of lime and Paris green were tried in a similar way and with equally good success. The caterpillars may readily be destroyed in their nests by saturating with kerosene and burning. A list of the more important publications concerning the tent caterpillar is appended to these remarks.

Spraying experiments against the spring cankerworm (pp. 298–301).—In the experiments against the spring cankerworm Paris green was used upon 1 plat which consisted of about 100 trees. The Paris green was applied 3 times at the strength of 1 lb. to 150 gal. of limewater. The first application was made as soon as the young caterpillars appeared, the second about a week later, and the third 4 days after the second. A second plat consisting of 14 trees was sprayed with green arsenite in the proportion of 1 lb. to 150 gal. of limewater. "Four days after the second application a very few live caterpillars could be found. The results were practically the same on the 2 plats."

In comparing these 3 arsenicals, the author remarks that the results were about the same with each. No damage was done to the foliage in any case, the effectiveness of all 3 poisons was about the same. Paris green is the more expensive of the 3. Arsenite of lime, which has the advantage that it can be made at home, costs about 3¾ cts. per barrel ready for use, while Paris green costs about 10 cts. per barrel of solution of proper strength and green arsenite about 5 cts. per barrel.

The potato-stalk weevil (*Trichobaris trinotata*), E. E. FAVILLE and P. J. PARROTT (*Kansas Sta. Bul. 82, pp. 12, figs. 15*).—The food plants of the stalk weevil besides the potato are *Solanum carolinense*, *S. rostratum*, *Xanthium canadense*, *Datura stramonium*, *Physalis longifolia*. The weevil is said to be more common in the last-named plant than in the potato. The various stages of the insect are figured and described. Egg laying commences the first of June; the larva hatches in about 10 days; the pupal stage lasts from 8 to 11 days, and there is but one brood per year. The adult passes the winter in the plant in which it has gone through with its transformations.

As remedies, therefore, the author recommends the destruction of all potato vines as soon as possible after the potatoes are dug, and also of the other food plants mentioned above. Spraying with Paris green or London purple is also quite successful. In small plats of potatoes the weevil may be captured by sweeping the vines with an insect net. The only parasite mentioned is *Sigalphus curculionis*.

Some comparative trials of insecticide pumps in relation to the treatment of tea blights, and experiments in the treatment of red spider, W. J. FLEET (*Indian Mus. Notes, 4 (1899), No. 3, pp. 113–117, pls. 2*).—The author used a number of patented dust blowers and spraying machines for the destruction of the red spider (*Tetranychus bioculatus*). A number of insecticides were used, and the best results were obtained with pure sulphur blown upon the bushes in the early morning before the dew was gone. The insecticide is cheap, easily applied, and very efficient.

Spray pumps and spraying, W. PADDOCK (*New York State Sta. Bul. 121, App., p. 8, figs. 2*).—The bulletin serves as a supplement to Bulletin 121 (E. S. R., 9, p. 262). It gives a description of the Kerowater machine for making a mechanical mixture of kerosene and water. The author calls attention to the advantages of a removable top to the spray barrel. Brief notes are given on the relative value of the copper sulphate solution, Paris green dissolved in ammonia, London purple, green arsenite, arsenite of lime, and the kerosene and water mechanical mixture. Injury to the leaves is said to result frequently from the use of the kerosene and water mechanical mixture as well as from the copper sulphate solution and Paris green dissolved in ammonia.

The State entomological department (*Meddel. K. Landtbr. Styr., 1898, No. 48, pp. 279–286, pl. 1, figs. 2*).—This is a brief report, accompanied with a photograph of the exterior and the plans of the interior of the entomological building and insectary.

Collecting insects, W. J. HOLLAND (*Pop. Sci., 33 (1899), No. 6, pp. 122, 123*).—Gives general directions and descriptions of apparatus.

Molting of insects as a means of defense, K. D'HERCULAIS (*Compt. Rend. Acad. Sci. Paris, 128 (1899), No. 10, pp. 620–622*).—On account of the free casting off of the skin and lining of the trachea, it was found difficult to infect certain grasshoppers with fungus diseases.

Apiculture, J. PONS (*El Agricultor, 1 (1899), No. 3, pp. 6, 7*).

Bees and how to manage them, A. GALE (*Agr. Gaz. New South Wales, 10 (1899), Nos. 1, pp. 84–86; 2, pp. 194–196, pl. 1*).—Contains a detailed description of the Langstroth hive with direction for its use.

Demonstration of the sense of hearing in bees, SYLVIAC (*L'Apiculteur, 43 (1899), No. 5, pp. 204–206*).—Proved by the ordinary test of responding to the stimuli of various sounds.

Life in a winter bee cellar, G. E. WALSH (*Sci. Amer., 80 (1899), No. 23, p. 380*).—A plan for the management of bees in a winter cellar.

The Notre Dame beehive and wintering device, B. J. CHRYSOSTOM (*Amer. Bee Jour., 39 (1899), No. 24, pp. 369, 370*).—A description of the hive and records of temperatures taken at different times in the packing about the hives.

A second plan for ventilating bees, W. T. CRAWFORD (*Southland Queen, 5 (1899), No. 1, pp. 4–7*).—Details of a plan of construction of hives for the purpose of gaining the benefits of currents of air.

The advantages of preventing swarming by artificial means, R. PINCOT (*L'Apiculteur, 43 (1899), No. 5, pp. 198–202*).—Prevents the excessive production of drones and insures the collecting of a greater quantity of honey.

Comb honey, A. GALE (*Agr. Gaz. New South Wales, 10 (1899), No. 4, pp. 247–249, pls. 2*).—Gives directions as to arrangement of supers so as to get the most perfect comb honey.

Foul brood and its treatment, L. FORESTIER (*Rev. Internat. Apicult., 21 (1899), No. 5, pp. 92–98, fig. 1*).—The symptoms of the disease are described in detail. The remedies recommended are beta-naphthol and formic acid. The ordinary preventive measures are described.

Foul brood in Burgundy, F. Jules (*Rev. Internat. Apicult., 21 (1899), No. 4, pp. 68–74*).—A discussion of the predisposing causes of the disease, of the means of contagion, and of remedies to be applied.

On the properties of cocoons of the various silkworm races of Japan, J. Kawara (*Imp. Univ. Col. of Agr. [Tokyo] Bul., 3 (1898), No. 5, pp. 508–520*).—A report of an investigation of the ductility, strength, size, and other properties of silk thread from different races of cocoons.

A preliminary study of ticks, E. P. Niles (*Virginia Sta. Bul. 86, pp. 25–30, pls. 4*).—The bulletin contains technical descriptions and notes on the life history of the following species of ticks: The "Lone Star Tick" (*Amblyomma unipunctata*), the cattle tick (*Boophilus bovis*), the wood tick (*Dermacentor americanus*), the cattle tick of California (*D. occidentalis* and (*Ixodes ricinus*). All the species are figured as well as some of their anatomical details.

The systematic position of the Pulicidæ, R. Heymons (*Zool. Anz., 22 (1899), No. 588, pp. 223–240*).—From a detailed study of their anatomy and morphological relations, the author concludes that fleas should be considered an independent order, Siphonaptera.

Entomology, M. V. Slingerland (*Trans. New York State Agr. Soc., 1897, pp. 507–525*).—Brief notes on plant lice, pear psylla, apple-tree tent caterpillar, cankerworms, San José scale, and the quince curculio.

Insect pests, W. W. Froggatt (*Agr. Gaz. New South Wales, 10 (1899), No. 4, pp. 268–271, pls. 2*).—Notes on the fig-branch borer (*Hylesinus porcatus*) and the lucerne web moth (*Tortrix glaphyriana*).

The wood-boring insects of fruit trees, Schule (*Wchnbl. Landw. Ver. Baden, 1899, No. 5, pp. 50–52*).

Two apple pests and how to check them, F. H. Hall and V. H. Lowe (*New York State Sta. Bul. 152, popular ed., pp. 8, figs. 3*).—A popular summary of Bulletin 152 of the station (see p. 170).

Insect enemies of the peach, H. N. Starnes (*Georgia Sta. Bul. 42, pp. 225–229, figs. 7*).—Notes on nematode galls (*Heterodera radicicola*), peach borer (*Sannina exitiosa*), fruit-bark borer (*Scolytus rugulosus*), curculio (*Conotrachelus nenuphar*), and San José scale (*Aspidiotus perniciosus*).

Insect and fungus enemies of fruit trees and their remedies (*Agr. Gaz. New South Wales, 10 (1899), No. 1, pp. 26–31*).—A popular account of Phylloxera with suggestions as to remedies. Also contains a description of white rot, anthracnose, and sun scald.

The San José scale in Idaho, J. M. Aldrich (*Idaho Sta. Bul. 16, pp. 16, pls. 2, figs. 3*).—The bulletin contains a description of the scale and a popular account of its habits and life history. The insect has become established in Idaho at two points, Lewiston and Boise. The sulphur, lime, salt, and lye solution was applied with good success.

The San José scale (*Amer. Florist, 14 (1899), No. 574, pp. 1309–1311*).—Gives the opinions of a number of economic entomologists on the value of an inspector's certificate.

The San José scale, G. Staes (*Tijdschr. Plantenziekten, 4 (1898), No. 2, pp. 45–60, figs. 7*).—The author gives a description and illustration of the insect, together with an account of its life history and habits. Its parasites and other natural enemies are mentioned, and the chief remedies are discussed, among them fumigation and the various washes.

Asia as the home of the San José scale, K. Sajo (*Illus. Landw. Ztg., 96 (1898), No. 96, p. 967*).—Gives evidence for the belief that the San José scale originally came from Asia.

The home of the woolly aphis, J. JABLONOWSKI (*Rov. Lapok., 6 (1899), No. 2, pp. 27-36*).—The author gives evidence for the view that the woolly aphis is native to America.

Schizoneura lanigera on fruit trees (*Deut. Landw. Presse, 26 (1899), No. 41, p. 467, figs. 3*).—Figures and describes the insect with an account of the common insecticides.

The grass or harvest mite as a pest of field workers (*Deut. Landw. Presse, 25 (1898), No. 98, p. 1016*).—A popular account of the vexation caused by the presence of large numbers of this pest with mention of remedies to be used.

The red spider or spinning mite (Tetranychus telarius), G. STAES (*Tijdschr. Plantenziekten, 4 (1898), No. 3, pp. 83-92, figs. 3*).—Contains a description of its method of attack upon plants with suggestions of a number of remedies, such as flowers of sulphur, liver of sulphur, kerosene emulsion, and lysol.

Biological observations on forest Hymenoptera, L. G. SEURAT (*Bul. Mus. Hist. Nat. [Paris], 1898, pp. 364-369*).—A longicorn beetle (*Callidium sanguineum*) which attacks the oak is preyed upon by the following hymenopterous parasites: *Doryctes gallicus, Helcon tardator*, and *Phytodictus corvinus*.

May beetles and white grubs, E. S. ZÜRN (*Fühling's Landw. Ztg., 48 (1899), No. 9, pp. 346-350*).—An account of the injuries caused by white grubs with a discussion of remedies. May beetles when cooked are said to be excellent food for cattle. The constituents of the body of the May beetle are tabulated from a chemical analysis.

Lepidopterological notes, O. J. LIE-PETTERSON (*Bergen Museum Aarbog, 1898, Afhand, No. 14, pp. 12*).—Gives notes on various butterflies.

Notes on butterflies with descriptions of new species, H. SKINNER (*Ent. News, 10 (1899), No. 5, pp. 111-113*).—New species of Pamphila are described with notes on their habits.

The orchid bug (Phytocoris militaris), G. STAES (*Tijdschr. Plantenziekten, 4 (1898), No. 3, pp. 61-64, fig. 1*).—The insect is described and figured. Quassia chips are recommended as a remedy for preventing its injuries.

The orchid beetle (Xyleborus perforans), G. STAES (*Tijdschr. Plantenziekten, 4 (1898), No. 4, pp. 93-97, figs. 3*).—The beetle is figured and an account is given of its injuries and of remedies to be recommended for use against it, among them being the burning of infested stems.

On the destruction of ground fleas, R. THIELE (*Ztschr. Pflanzenkrank., 8 (1898), No. 6, pp. 312-314*).—The remedies which were used against this insect were lime dust and tobacco dust with various sulphur preparations. A concentrated sugar and gum arabic solution was added to make the insecticides adhere.

The destruction of fruit pests, A. H. BENSON (*Queensland Agr. Jour., 4 (1899), No. 4, pp. 264-280, pls. 5*).—General directions are given for the preparation of the better known insecticides. For the convenience of horticulturists, insects are classified according to their habits, and an alphabetical list of fruit trees is arranged in parallel columns with the common diseases to which they are subject and the remedies to be applied.

The author gives a description of the method and apparatus for applying the gas treatment to living trees.

Cochylis and lantern traps, C. MESTRE (*Prog. Agr. et Vit. [Ed. L'Est], 20 (1899), No. 20, pp. 599-602*).—Notes on the use of the lantern trap and the cost of its operation.

Cyanid of potassium as an insecticide, H. DIXON (*Gard. Chron., 3. ser., 24 (1898), No. 625, pp. 432, 433*).—A brief discussion of its use and value for fumigation.

Insecticides and spraying calendar, S. T. MAYNARD (*Massachusetts Hatch Sta. Bul. 60, pp. 11*).—Gives directions regarding the choosing of spray pumps and nozzles and regarding the preparation of the following insecticides and fungicides: Paris green, arsenate of lead, kerosene emulsion, kerosene water, pyrethrum, hellebore, Bordeaux mixture, and copper sulphate solution.

A spraying calendar is appended to the bulletin and covers a number of the more common diseases of fruit and garden vegetables.

The rational destruction of insects attacking fruit trees, F. DECAUX (*Jour. Soc. Nat. Hort. France, 3. ser., 21 (1899), pp. 158–184, figs. 3*).—Notes on the use of insecticides and parasites for controlling injurious insects.

A practical and simple insect band for fruit trees, G. STAES (*Tijdschr. Plantenziekten, 4 (1898), No. 2, pp. 35–44, figs. 9*).—A description with figure of a tarred paper band to be used against various fruit enemies.

Experiment with benzolin, D. G. JONKSEN (*Ztschr. Pflanzenkrank., 9 (1899), No. 1, pp. 29*).—Benzolin was used for the destruction of phylloxera without success.

The timely plowing under of stubble fields and its influence upon certain diseases of cereals, J. R. BOS (*Tijdschr. Plantenziekten, 4 (1898), No. 5, pp. 135–146*).—Mentions the effect of plowing under stubble fields at the right time upon the grain aphis, Hessian fly, and frit fly.

FOODS—ANIMAL PRODUCTION.

The nutritive value of soldiers' bread, K. PANNWITZ (*Der nahrwerth des Soldatenbrotes. Inaug. Diss. Berlin, 1898, pp. 123*).—A large number of experiments with men are reported on the digestibility of army bread made from rye flour containing 15 per cent bran; bread from coarse decorticated rye flour containing 7.5 per cent bran; bread from decorticated rye flour containing 15 per cent bran; bread from finely ground decorticated and undecorticated rye flour containing different amounts of bran, from finely ground wheat, and from finely ground bran; pumpernickel; and bread made from rye soaked and crushed without grinding. The principal conclusions were that ordinary army bread may be improved by removing the outer covering of the grain, even if the resulting flour is not more finely ground than at present. If finer grinding is practiced there is a still further improvement possible, since by the use of finer sieves the percentage of bran may be diminished from 15 to 25 per cent. Removing the outer covering of the grain has less effect upon the digestibility than the fineness of grinding and the amount of bran. The more completely the bran is removed the better the flour. Even if finely ground, bran is not a satisfactory food for man. Coarse breads are not regarded as satisfactory for feeding large numbers of persons, especially soldiers.

Beef cattle and swine, T. SHAW (*Minnesota Sta. Bul. 60, pp. 54, figs. 4*).—Tests are reported (1) on the possibility of profitably fattening steers in Minnesota; (2) on fattening range steers; and (3) on raising pork.

Growing beef in Minnesota (pp. 1–20).—To test the truth of the belief that steers can not be profitably fattened on farms in Minnesota in competition with western ranges, the author fed 2 calves from birth until about 30 months old. The foods selected were such as could be secured on any farm, and the care and management such as could be easily given by farmers in general. The calves chosen were a cross of grade Shorthorn cows and Shorthorn bulls. They were dropped in the fall. When taken from the cows they were fed new milk and later skim milk, meal, hay, ground corn, sorghum silage, and roots, and were pastured during the summer months. The grain ration included bran, oats, corn, barley, wheat, and oil cake. These were all ground and fed in such combinations as seemed desirable. The hay consisted chiefly of clover with a little timothy. The feeding stuffs were valued at market prices which varied considerably during the experimental period. The food consumed by the steers until 1 year old, between 1 and 2 years old, and after reaching the age of 2 years, is recorded. At the close of the test they were slaughtered and judged by experts. One steer was valued at $4.75 and the other at $4.40 per 100 lbs. Including the value at birth, the entire cost of raising one steer was $45.17 and the other $40.21. When slaughtered, the weights, making allowance for a shrinkage of 3 per cent, were 1,392 and 1,280 lbs., respectively. The profit on the first steer was $20.95 and on the second, $16.11. "But little fat was laid on externally, and the percentage of internal fat was not high. The outcome in the carcasses was not far different." The meat of both carcasses was of a very superior quality. "Throughout the loin and rib cuts and also in other parts of the carcass the admixture of the fat and lean . . . was . . . perfect. Particles of fat of more or less size flecked the lean in all the best cuts."

The principal conclusions from the test follow:

> "Since the steers were sold for $37.06 above the cost of production, under the conditions stated, it is just to conclude that a good profit can be made from growing beef in Minnesota, even when grown on the intensive plan.
>
> "The method of growing meat thus is applicable to average farm conditions in the State, since the foods fed may all be produced on the farm, except the bran and oil cake. The quality of meat thus grown is of the very best, and should therefore command the highest price in the market.
>
> "In growing beef as in this experiment, the farmer can get much better values for the food products which he grows by feeding them at home than by selling them directly."

Fattening range steers in winter (pp. 21-38).—A test was made with 9 steers, the principal object being to compare results obtained from fattening on large and smaller quantities of grain and to "gather information as to the behavior of range steers while under full feed."

After a preliminary period of 9 days, the test proper began November 15, 1897, and covered 194 days. The steers, which were part of a lot purchased in Montana, were about 2 years old, and showed Shorthorn-Hereford and Aberdeen-Poll blood. They were divided into 3 lots of 3 each. It was the author's intention to feed lot 1 a light grain ration, lot 3 a heavy grain ration, and lot 2 an intermediate grain ration. The grain consisted of bran, barley, and corn in different proportions. It was not possible to complete the experiment on these lines, and the gains made by the individual steers are recorded.

The financial statement is based on bran at $7.50, oil cake at $22, mixed hay at $4, and corn silage at $1.25 per ton; barley at 18 cts., and corn at 22 cts. per bushel. The value of the steers at the beginning of the test was $2.69 per 100 lbs., and at the close $4.62½. The average weight at the beginning was 1,038, and at the close 1,317 lbs. The average daily consumption of meal per steer during the entire period of feeding was 12.19 lbs., the average daily consumption of food being 23.89 lbs., and the average cost of food per pound of gain was 5.92 cts. The net profit on feeding the 9 steers, deducting the freight, was $141.54. Some of the steers were very restless when tied in stalls, and the author believes that range steers are not very suitable for fattening in this way. The tests are discussed at some length and compared with earlier work of the station.

Feeding pigs of different grades (pp. 39–54).—In the author's opinion, it is desirable to breed pigs which shall have the characteristics of the so-called bacon hog; that is, the carcass shall not show an excessive amount of fat. In his opinion, such pigs may be secured by selection and by crossing.

A test, which began July 13, 1896, and covered 112 days, is reported with 6 first cross Yorkshire-Tamworth pigs and with 6 second cross pigs of the same breed. The special object of the test was to compare the relative merits of first and second crosses from Improved Yorkshire sires for fattening, and to compare corn and barley as foods for pigs. The pigs were divided into 4 lots of 3 each, lots 1 and 3 being made up of pigs of the first cross and lots 2 and 4 of pigs of the second cross. All the pigs were 108 days old when the test began. The test was divided into 3 periods of 28 days. In the first period, lots 1 and 2 were fed oats and corn 3:1; during the second period, the same foods in equal parts; and during the third period, in the proportion of 1:3. During the fourth period, corn only was fed. The rations fed lots 3 and 4 were similar except that barley was substituted for corn. The grain was fed ground and was soaked in water 6 or 12 hours before feeding. The pigs were given all they would eat up clean with a relish. They were given green food in season, either corn, second growth clover, rape, or cabbage.

The financial statement is based upon oats at 14 cts., barley at 16 cts., corn at 18 cts. per bushel, and green food at 75 cts. per ton. An allowance of 5 cts. per sack was made for grinding the grain. At the close of the test the pigs were sold for $3.15 per 100 lbs. The results, which are recorded in detail for the different lots and different periods, are summarized in the following table:

Results of feeding barley and corn to cross-bred pigs.

	Food consumed.				Weight at beginning.	Gain in weight.	Cost of food per pound of gain.	Profit.
	Oats.	Corn.	Barley.	Green food.				
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Cents.*	
Lot 1 (corn)	414	980	....	322	247	354	1 65	$5.68
Lot 2 (corn)	449.5	1,033.5	....	297	275	328	1 89	4.53
Lot 3 (barley)	570	....	808	267	247	279	1.83	4.04
Lot 4 (barley)	458	....	826	297	279	288	1.96	3.94

The conclusions are as follows:

"Because of the low relative gains made by the pigs in all the lots during the first period of feeding and because of the relative increase in the gains subsequently as the proportion of the oats fed was lessened, the conclusion would seem to be legitimate that a diet in which oats is a predominant factor is not the most suitable one than can be fed to pigs while being grown and fattened.

"[Owing to] the low consumption of food by the pigs to which barley was fed, the conclusion would seem to be legitimate that the free use of barley long continued in growing and fattening pigs tends to weaken the appetite at least to some extent.

"[On account of] the low gains made by pigs to which barley was fed, the conclusion would seem to be fair that a barley diet long continued is not quite so well fitted to make increase in weight as a corn diet, the other adjuncts being the same as in the experiment.

"Since the pigs of the first cross made somewhat better gains and on less food than those of the second cross this experiment favors the view that they were a little more easily kept.

"Because of the smallness of the difference in the relative gains of the animal of the two respective crosses, the experiment does not prove that one cross, as such, has any superiority over the other in capacity to make gains.

"With the prices of food and meat as in the experiment, 100 lbs. of pork may be produced at a cost of $1.83 and yielding a profit of $1.32."

The cost of raising calves, F. W. MORSE (*New Hampshire Sta. Bul. 58, pp. 157-166*).—To secure data in regard to the cost of raising a dairy cow, the amount and cost of food consumed by a number of calves from the time they were weaned until 16 months old were recorded, as well as statistics of the breed, ages, weights, and weekly gains. The records include statistics of 13 animals and cover all seasons of the year. The financial statement is based on the following prices per 100 lbs.: Milk $1, skim-milk 20 cts., flaxseed $3.25, middlings 80 cts., bran 70 cts., linseed meal $1.25, oats $1, oatena 65 cts., mixed grain (middlings, oat feed, and linseed meal 2:2:1) 90 cts., hay 50 cts., and green barley fodder 15 cts.

It was found that 8 calves under 5 weeks old made an average weekly gain of 7.6 lbs. at a cost of 40.6 cts.; from 5 to 9 weeks the average weekly gain was 9.1 lbs. and the cost 36.7 cts. The same number of calves from 9 to 13 weeks old made an average weekly gain of 11.8 lbs. at an average cost of 43.1 cts. Eight calves from 13 to 20 weeks old gained per week on an average 10 lbs. at a cost of 52.9 cts.; 6 calves from 4 to 8 months old made an average weekly gain of 11.1 lbs. at a cost of 63.7 cts.; 2 calves from 8 to 13 months old made an average weekly gain of 5.25 lbs. at a cost of 58.3 cts.; 4 heifers 13 to 16 months old made an average weekly gain of 6.12 lbs. at a cost of 65.1 cts. per week; 4 of the heifers were maintained on pasture from July 24 to October 26, 1897, and the total gain in weight of the 4 animals was 313 lbs.

The author discusses the results in detail, quoting the work of other stations:

"During the feeding periods . . . comparisons were made between cooked ground flaxseed and cooked middlings as a substitute for the fat in milk, and also between rations including the cooked food and those without it.

"[In one trial] the calves were between 5 and 8 months old and the middlings proved to be a satisfactory substitute for the ground flaxseed, the cost being less and the gain in weight large enough for the purpose, though a little smaller than on the flaxseed.

"The calves [in another trial] were also over 5 months old. The substitution of the dry grain lessened the cost, and the gain was sufficiently large, although smaller than in the previous period.

"These trials show that for calves at the age of those described there is no object in using anything but dry grain and hay along with the skim milk, unless the greatest possible amount of growth is desired.

"[The cost of rearing a calf dropped October 1 is calculated as follows:] For 5 months, or 21⅗ weeks, the cost according to our own data would be 44.2 cts. per week, or $9.57. For the next 3 months, or 13 weeks, our data would make the cost 63.7 cts. per week, or $8.28.

"The pasture season would now be at hand and continue for 5 months, and the cost would vary with the location. The figures that we have obtained for calves range between $1.50 and $2.50 for the season.

"The remaining 3 months would cost according to our data 65.1 cts. per week, or $8.46 for the 13 weeks. The total cost for the food consumed by the heifer during the 16 months would then be $28.81 and she would weigh from 600 to 700 lbs. . . .

"In conclusion . . . high-priced foods, viz, whole milk, flaxseed, linseed meal, and oats, will cause the cost of the weekly ration to increase out of proportion to the gain, if fed freely. Flaxseed can not be used with economy except in the earliest stages of growth, the first 2 or 3 months, and whole milk should be discontinued as soon as possible."

Fattening lambs and wethers in winter, T. SHAW (*Minnesota Sta. Bul. 59, pp. 511–560, figs. 3*).—A number of tests made during the winters of 1896–97 and 1897–98 on fattening lambs and wethers are reported. They include the following topics: Fattening home-grown lambs, potatoes and field roots as food factors in fattening lambs, and fattening range wethers.

Fattening home-grown lambs (pp. 511–526).—Two tests are reported. The first was made with 10 wethers bred from pure bred Dorset sires and common-grade dams. They were grown on the station farm and had been fed almost entirely on summer forage other than grass. They had grazed with their dams from May 1 until about November 1, neither receiving any grain the greater portion of the season. After a preliminary period of 14 days, the test proper began November 23, 1896, and covered 16 weeks. The lambs were fed a grain ration consisting of oats, bran, barley, and oil cake, 3:3:3:1, together with native hay of poor quality, and mangel-wurzels and carrots in about equal parts. The grain was fed unground and the hay uncut. They received all the hay and grain they would eat up clean, and what in the author's opinion was a liberal allowance of roots. They had access to a shed and yard with a southern exposure.

The financial statement is based on bran at $6.50, oil cake at $14, and native hay at $3 per ton; corn at 18 cts., barley at 16 cts., and oats at 14 cts. per bushel; and roots at 9 cts. per 100 lbs. The average weight of the lambs at the beginning of the preliminary period was 90 lbs., at the beginning of the experiment proper 93.2 lbs., and at the close 134.2 lbs. During the test proper the average amount of food consumed per lamb per day was 5.09 lbs. Shortly after the close of the test the lambs were sold and slaughtered. They were valued at $3.50 per 100 lbs. at the beginning of the test and were sold for $5.50 per 100 lbs. The total profit per lamb was $2.43. In the opinion of experts, the mutton was of high excellence. Notwithstanding its high finish, the proportion of lean to fat was unusually large and the blending or intermingling of fat and lean was very satisfactory.

The principal conclusions drawn from the test were that "it is possible to so fatten lambs that the finish will be of a high order without unduly loading them with fat."

"Such a diet [as given] is eminently adapted to the production of large gains, since during the experiment proper it produced monthly 11 lbs. of increase. Such a ration is also eminently adapted to sustaining the ratio of increase during a long feeding period, since the lambs gained about as much during the last part of the feeding period as during the first part. It is admirably adapted to the cheap production of mutton, since 100 lbs. of increase was made during the entire period of feeding at a cost of but $3.41. The growing of lambs on forage other than grass pastures leaves them in a fair condition for being successfully fattened."

The second test, which was made with 9 lambs (all wethers but one), began November 15, 1897, and covered a period of 112 days. The lambs were dropped at the station farm in the spring of 1897, and were what remained after the best had been sold or selected for breeding purposes. "They were not really culls, but they were under the average of well-grown farm lambs. Nearly all of them were from a Dorset sire and grade ewes."

The lambs were confined in a shed with a yard and were fed a grain ration consisting of oil cake, bran, barley, and oats, 1:2:3:4. In addition they were given clover and timothy hay, the former predominating, and during the last 70 days of the test sorghum silage in addition. The barley and oats were fed whole; the hay was uncut. The lambs were given silage in the evening only; all other foods twice a day. This lot was compared with range lambs fed in a similar way (E. S. R., 6, p. 576).

The financial statement is based on oil cake at $22, wheat bran at $7.50, hay at $4, and silage at $1.20 per ton; barley at 20 cts. and oats at 17 cts. per bushel.

The average weight of the lambs at the beginning of the test was 72.5 lbs.; the average gain per lamb, 34.9 lbs.; and the cost of a pound of gain 4.07 cts. Shortly after the close of the test the lambs were sold and slaughtered. They were valued at $3.41 per 100 lbs. at the beginning of the test and $5.50 at the close. The total profit per lamb was $1.83, or 28 cts. more than was obtained with the range lambs fed in a similar way. "The explanation is found in the greater weight of the home-bred lambs at the beginning of the experiment and the increase in value put upon the original weight by fattening the lambs. And this result is probably the most important fact to be emphasized in the bulletin."

Potatoes and field roots as food factors in fattening lambs (pp. 527–537).—The value of potatoes and roots for fattening lambs was tested with 36 lambs divided into 3 lots of 12 each. They were the culls of a carload purchased in Montana. After a preliminary period of 7 days the test proper began November 22, 1897, and closed February 28. All the lambs were fed a grain ration consisting of equal parts by weight of corn, barley, and oil cake, with uncut clover and timothy hay in addition, the clover predominating. In addition lot 1 was fed potatoes, lot 2 mangel-wurzels, and lot 3 sugar beets. The potatoes and roots were sliced and fed with the grain, which was unground. The lambs were fed twice a day. They were gradually led up to a full ration and were given all the grain they would eat up clean.

The financial statement is based on hay at $4 and oil cake at $22 per ton, corn at 22 cts., barley at 20 cts., potatoes at 20 cts., mangel-wurzels at 5 cts., and sugar beets at 5½ cts. per bushel. The lambs were valued at $3.34 per 100 lbs. at the beginning of the test, and were sold for $5 per 100 lbs. (shrunk weight) at the close.

The 3 lots consumed practically the same amounts of grain, hay, and roots. The principal results of the test are shown in the following table:

Results of feeding potatoes and roots to lambs.

	Average weight per lamb at beginning of preliminary period	Average weight per lamb at beginning of test proper.	Average gain per lamb.	Food consumed per lamb per day.	Cost of food per pound of gain.	Total profit per lamb.
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Cents.*	
Lot 1, potatoes	49.6	50.6	32.9	3.52	4.94	$0.86
Lot 2, mangel-wurzels	49.8	50.8	30.6	3.52	4.20	1.07
Lot 3, sugar beets	49.6	50.6	34.6	3.57	3.78	1.24

The conclusions drawn from the test were the following:

"Lambs of but indifferent development may be fed at a substantial profit with food and meat at the values named in this experiment.

"In feeding lambs, potatoes compare favorably with mangel-wurzels and sugar beets in producing increase in weight, but they are more costly food than the roots named. Because of the greater cost of potatoes as compared with mangel-wurzels and sugar beets, they should not be grown as food for lambs where the latter can be grown successfully.

"Judging by the results obtained in this one experiment, sugar beets are a more valuable food for fattening lambs than either potatoes or mangel-wurzels."

Fattening range wethers (pp. 538–560).—Two tests are reported on fattening range wethers. The first began November 16, 1896, and covered 84 days. It was preceded by a preliminary period of 6 days, and was made with 20 wethers selected from a carload purchased in Montana. They were grades, Merino blood predominating, and were from 1 to 3 years old. They were given a grain ration of oil cake, bran, and corn, and oats, 1:2:3:4, and in addition native hay of unsatisfactory quality.

The financial statement is based on oil cake at $14, wheat bran at $6.50, and native hay at $3 per ton; corn at 18 cts. and oats at 14 cts. per bushel. The average weight of the wethers at the beginning of the test was 116.8 lbs., and at its close 140.3 lbs. They were valued at $3.37 per 100 lbs. at the beginning of the test and at $4 per 100 lbs. at the close. The average net profit per wether during the test was 36 cts.

The results obtained in feeding wethers were compared with those from feeding lambs. The greater profit in the case of the lambs in the author's opinion was due to the greater gains made by them, and also to a relatively greater advance in the value of the product. "If as much profit is to be made from feeding wethers as from feeding lambs, it would seem to be necessary to buy them at a considerably smaller price per 100 lbs."

The second test, which was preceded by a preliminary period of 6 days, began November 8 and covered 87 days, 20 wethers selected from a carload purchased in Montana being used. They were regarded as somewhat better than the average range wethers, though inferior to those raised on the farm. They were fed a grain ration consisting of oil cake, wheat bran, corn, and oats, 1:2:3:4, with clover and timothy hay, the former predominating. During the latter part of the test sorghum silage was also fed. The corn and barley were unground and the hay uncut. The wethers were fed all they would eat up clean. This lot was compared with the lambs described in a previous publication (E. S. R., 10, p. 576).

The financial statement is based on oil cake at $22, wheat bran at $7.50, hay at $4, and sorghum silage at $1.20 per ton; corn at 22 cts., barley at 20 cts., and oats at 17 cts. per bushel. The wethers were valued at $3.80 per 100 lbs. at the beginning of the test, and were sold for $4.50 per 100 lbs. shrunk weight. The average weight at the beginning of the test was 117 lbs. and at the close 150 lbs. The average amount of food consumed per day was 5.27 lbs.; and the cost of food per pound of gain 4.83 cts. The profit per head was $2.30. The principal conclusions follow:

> "When wethers and lambs are bought at the same price per pound and are fattened under similar conditions, the lambs are likely to bring considerably more profit. This increased profit is likely to arise first, from the greater relative advance at which the lambs will probably be sold, and second, from the greater relative gains which the lambs are likely to make on a given amount of food.
>
> "This profit may be expected to increase with the decrease in the difference between the weight of the wethers and lambs respectively at the time of purchase, because of the influence which weight at the beginning of an experiment exercises upon any advance made in mutton values."

Alfalfa hay for fattening hogs (*Kansas Sta. Press Bul. 25, p. 1*).—A test of the value of alfalfa hay for pigs is briefly reported. Forty pigs, weighing on an average about 125 lbs., were divided into 4 lots of 10 each. Lot 1 was fed dry Kafir-corn meal and alfalfa hay, lot 2 whole Kafir corn, lot 3 dry Kafir-corn meal, and lot 4 wet Kafir-corn meal. The alfalfa hay was of the best quality and carefully cured. It was fed dry in a large feeding trough. The pigs were confined in large pens with open sheds. The test began November 24, 1898, and covered 9 weeks. Lot 1 gained 90.9 lbs. or 10.88 lbs. per bushel of dry corn meal and 70.83 lbs. of alfalfa; lot 2 gained 59.4 lbs. or 8.56 lbs. per bushel of grain; lot 3 gained 52.4 lbs. or 7.48 lbs. per bushel of grain; and lot 4 gained 63.3 lbs. or 8.09 lbs. per bushel of grain.

"These results are not due to the feeding value of the alfalfa alone, but also to its influence in aiding the hogs to better digest the Kafir corn. The alfalfa hay also gave a variety to the ration, making it more appetizing and inducing the hogs to eat more grain. . . . The hay-fed hogs ate more grain and gained more for each bushel eaten.

"In a former experiment at this college pigs were pastured through the summer on alfalfa with a light feeding of corn. After deducting the probable gain from the corn, the gain per acre from the alfalfa pasture was 776 lbs. of pork.

"These facts indicate that to produce pork most cheaply the Kansas farmer must have alfalfa pasture in summer and alfalfa hay in winter."

Silage for horses, D. O. NOURSE (*Virginia Sta. Bul. 80, pp. 97, 98*).—In view of the scarcity of forage crops in some parts of Virginia, the author made a number of tests in which corn silage was fed to 2 horses and 6 mules. The animals were given small amounts of silage for some weeks before the test proper. After the preliminary period they were fed for 6 weeks all the silage they would eat, with hay and corn in addition. The amounts of food consumed and the weights of the animals are recorded. The silage was not as readily eaten by horses as by cattle and in the author's opinion horses, after becoming accustomed to silage, eat no more than they can easily assimilate.

Some trouble has been reported in feeding silage to horses. The author believes this may be attributed to feeding too large quantities at the start. In his own tests—

"There was no falling off in flesh and this though all the animals were constantly at work, except during stormy weather. They all made gains in weight, but those fed silage, corn, and hay, and the others fed corn and hay alone, gained about equally, so this fact amounted to nothing except an indication of good health. As a whole it would appear that silage would make good coarse fodder for horses when used in connection with hay or stover and grain, but that the animal should become accustomed to the food by degrees, and that this is as important as when changing from old to new corn, or from hay to grass."

Culinary encyclopedia, C. H. SENN (*London: Spottiswoode & Co., 1898, pp. 96*).—This is a revised and improved edition. The names of foods, utensils, condiments and beverages, and technical terms pertaining to them are defined.

Plain words about food, ELLEN A. RICHARDS (*Boston: Home Science Publishing Co., 1899, pp. 176; rev. in Amer. Kitchen Mag., 11 (1899), No. 31, p. 121*).

Diet in ancient times, J. MARCUSE (*Ztschr. Diätet. u. Phys. Ther., 2 (1898), No. 3, pp. 222–238*).—A historical study.

Researches on bread, E. PODA (*Abs. in Jour. Hyg., 24 (1899), No. 1177, p. 117*).—A study of the comparative value of wheat and rye bread.

Mushrooms as food, C. F. Langworthy (*Plant World, 2 (1899), No. 8, pp. 134–136*).—A popular summary of the subject pointing out the fact that mushrooms have very little food value, but are valuable as condiments.

On the value of sugar for the production of energy by man, Schumburg (*Ztschr. Diätet. u. Phys. Ther., 2 (1898), No. 3, pp. 185–188*).

The value of sugar as a nutrient, Chauveau (*Bul. Med., 1898, Mar. 23; abs. in Ztschr Diätet. u. Phys. Ther., 1 (1898), No. 4, pp. 259, 260*).

Effect of alcohol on metabolism in man, R. Rosemann (*Ztschr. Diätet. u. Phys. Ther., 1 (1898), No. 2, pp. 138–155*).

The function of water in metabolism and in the feeding of man, A. Dennig (*Ztschr. Diätet. u. Phys. Ther., 1 (1898), No. 4, pp. 281–299, dgms. 4; 2 (1898), No. 4, pp. 292–323, figs. 7*).—A number of experiments are reported in which the balance of income and outgo of nitrogen was determined.

Digestion and assimilation of nursing infants in health and disease, together with the rational method of feeding infants, L. de Jager (*Die Verdauung und Assimilation des gesunden und kranken Säuglings, nebst einer rationellen Methode zur Säuglingsarnährung. Berlin: Oscar Coblentz, 1898, pp. 43; abs. in Hyg. Rundschau, 9 (1899), No. 9, pp. 466, 467*).

The nutritive value of the food constituents for infants, A. Vanderpoel (*New York Med. Jour. 1898; abs. in Ztschr. Diätet. u. Phys. Ther., 2 (1898), No. 4, pp. 335, 336.*)

Food adulteration, Carmody (*Proc. Victoria Inst. Trinidad, 1899, pt. 3, pp. 197–212*).—A paper (with discussion) read before the Victoria Institute.

Boron food preservatives and their influence on the human organism (*London: Perkins, Bacon & Co., Ltd., pp. 63*).

Digestibility of protein preparations, Vis and G. Treupel (*München. Med. Wchnschr., 45 (1898), No. 9; abs. in Ztschr. Diätet. u. Phys. Ther., 1 (1898), No. 1, pp. 83, 84*).

Gains in body weight and the transformation of fat into glycogen, Bouchar (*Semaine Med. Paris, 18 (1898), Oct. 19: rev. in Ztschr. Diätet. u. Phys. Ther., 2 (1898), No. 3, pp. 246, 247*).

General animal production, L. Hoffmann (*Allgemeine Thierzucht. Stuttgart: E. Ulmer, pp. XVI + 547, figs. 25*).—The subtitle states this is a text-book and handbook for students, and for practical use.

Calculating the rations of animals, G. Martinet (*Fed. Soc. Agr. Suisse Romande, pp. 16*).—A general discussion of the subject.

A new system of pasturing sheep, T. Shaw (*Minneapolis, Minn.: Northrup, King & Co., 1898, pp. 17, figs. 9*).—On the basis of investigations carried on at the Minnesota Station the author advocates growing forage crops for sheep.

On the care of horses, F. Pogson (*Proc. Victoria Inst. Trinidad, 1899, pt. 3, pp. 274–284*).—A general article (with discussion) read before the Victoria Institute.

DAIRY FARMING—DAIRYING.

The effect of food on the quality of milk, E. O. Arenander (*Nord. Mejeri Tidn., 14 (1899), Nos. 6, pp. 76, 77; 7, p. 91*).—Analyses of about 2,000 samples of milk delivered at creameries in Norrland (Sweden) were made at the chemical plant-biological station at Luleå and published in the report of the station for 1897. The results show in a striking manner that the fat content of milk may be reduced 1 to 2 per cent below normal by scant feeding. During the period from January to May, Norrland cows are in general fed only a meager allowance of marsh hay or old stock hay, and hence are in a very poor condition when turned out on pasture in June. The results of the analyses published point clearly to three periods of feeding, namely, (1) pasture

(June to September), (2) ample stable feeding (October to December), and (3) scant stable feeding (January to May). The variations in the fat content of the milk during these periods are shown in the following table:

Fat content of milk as affected by quantity of food.

Period.	Variations in fat content.		
	Maximum.	Minimum.	Average.
	Per cent.	*Per cent*	*Per cent*
1 (June to September), pasturage	5.0–5.8	2.65–2.9	3.71–4.25
2 (October to December), ample stable feeding	4.1–4.2	2.30–2.9	3.32–3.52
3 (January to May), scant stable feeding	4.0–4.6	1.10–1.9	3 20–3.30

The average fat content for the year was 3.35 per cent. The author concludes that the fat content of milk can not be increased at will by increasing a normal ration, but on the other hand that it can be greatly decreased by scant and poor rations. If a change is made from a deficient to a normal ration the fat content of the milk will again be raised to the limit determined by the inherent qualities of the individual cow.

The high fat content of milk from cows on pasture is considered remarkable, and is attributed in part to the effect of the healthful summer climate of northern regions.—F. W. WOLL.

Do cows of mountain breeds yield milk richer in fat than those of other breeds? P. HELLSTRÖM (*Landtmannen, 10 (1899), Nos. 16, pp. 217–254; 17, pp. 268–272*).—While the mountain breed of northern Sweden produces considerably richer milk (0.2 to 0.9 per cent) during the summer months than cows in southern or middle Sweden, the average percentage of fat in the milk for the whole year is very nearly the same in both regions. It is shown, however, that all cows in the northern latitude behave similarly in this respect, irrespective of breed. The author concludes that the power of producing rich milk must be considered an individual rather than a race characteristic, and that since the pure Swedish mountain breed produces on the average less fat during the year than the common mixed breed, the latter is, on the whole, the more profitable breed.—F. W. WOLL.

State and municipal milk legislation, A. T. NEALE (*Delaware Sta. Bul. 43, pp. 15–19*).—The hardship which the milk inspector of Philadelphia works to the farmer is illustrated by several cases in which milk, containing over 3.6 per cent of fat and over 12.3 per cent of solids, was condemned as below the standard in solids-not-fat (9.5 per cent). This standard appears to be an arbitrary one adopted by the city inspector, who holds that milk below it has been watered, and uses it as "the factor by which the percentum of adulteration is determined."

The variations which may result between night's and morning's milk where the interval between milkings differs considerably, is shown by the record of a cow. If the farmer sells milk to the city retail trade, "it is absolutely essential that the intervals between daily milkings shall be as nearly equal in length as is possible, for by this means only can he obtain a daily output uniform in quality."

A discussion of farm dairy methods, G. H. TRUE (*Michigan Sta. Bul. 167, pp. 113–126, fig. 1*).—A popular discussion of different methods of creaming milk, handling cream, and packing and printing butter, in which various tests made at the station are noted.

A comparison of deep setting in standing water and in running water at the same temperature showed no difference in the efficiency of creaming. Milk was set in deep cans immediately after milking, a half hour after, and one hour after, the water in all cases being at the same temperature and the milk never above 36° F. The fat content of the skim milk in the three cases was 0.216, 0.25, and 0.26 per cent, respectively. Tests of two separators at different rates of speed are briefly reported. Two trials comparing setting in shallow pans, cold deep-setting, and separating by means of a hand separator showed a saving of from 8 to 20 per cent of butter in favor of the separator method, with but little difference between the other methods. Creaming by dilution was tested in a 2-weeks' trial of a can known as the Wheeler Cream Separator. The average loss of fat amounted to 0.7 per cent; the skim milk being diluted about ½ with water could not be fed to advantage, and the cream soured rapidly. With churns filled ¼, ½, and ¾ full, other conditions being uniform, the time required for churning cream averaged 34, 56, and 64 minutes, respectively. The loss of fat in the buttermilk was practically the same in each case.

A strange property of the fat globules of milk, H. ATWOOD (*West Virginia Farm Review, 7 (1899), No. 5, pp. 129–132*).—A number of churning experiments are reported with cream from deep setting which was cooled to different temperatures and either held there for some time or churned almost immediately. Where the cream was cooled too rapidly or was not held at the low temperature a sufficient time "the globules in the cream were still too soft for good results, and this explains the reason for the larger amount of fat left in the buttermilk and the shorter time required for churning." This result was verified in a number of other experiments.

"The hardness of the fat globules of milk at any particular time does not depend entirely upon the temperature of the globules at that time, but is influenced materially by the previous temperature of the globules. In other words, the hardness or softness of the fat globules changes more slowly than the change in temperature of the milk or cream when this change is somewhat rapid."

Construction of cheese-curing rooms for maintaining temperatures of 58 to 68° F., F. H. KING (*Wisconsin Sta. Bul. 70, pp. 29, figs. 13*).—Reference is made to the previous studies of the station on the effect of temperature on the ripening of cheese (E. S. R., 10, p. 787), and records are given of the temperature of the soil and ground water and of the air in Wisconsin. In papers read before the Wisconsin Cheese

Makers' Association in 1893 and 1897 the author called attention to the possibility of utilizing the lower temperature of the subsoil and of the ground water for the purpose of cooling curing rooms. Since that time a number of factories in the State have been equipped with subearth ducts, either horizontal or vertical. A number of these are described and records given of their operation and effectiveness. Experiments are briefly noted in using an air blast for drawing air from a well and cooling a lecture room in the university.

. Advantage may be taken of the night air for cooling curing rooms when the temperature is sufficiently low. For this purpose the air should be taken in through a wind funnel rising not less than 15 ft. above the ridge of the roof of the factory. The employment of horizontal or vertical subearth ducts is regarded as more satisfactory. The horizontal duct should be at least 12 ft. below the surface and at least 100 ft. long, being connected at its outer extremity with a vertical flue, terminating in a funnel about 50 ft. in height. The duct may be constructed of a single line of large tile, but the author recommends either 3 rows of 10-in. drain tile or 5 rows of 8-in. tile, the cost being about the same for both sizes. These may be placed side by side, or the ditch may be dug narrower and deeper and the tile placed one above the other. The flue may be made of plank, with an opening 12 in. square, or of galvanized iron tubing 12 in. in diameter. The latter is regarded as preferable, as it is essential that the flue should be perfectly tight.

In cooling by vertical subearth ducts, a well 25 to 30 ft. deep should be dug, where the water is sufficiently far below the surface, and the flue communicating with the funnel should extend to the bottom of the well, where it leads into a series of 13 lines of 6-in. drain tile or 5-in. galvanized iron conductor pipe, which communicates with the curing room. The earth is packed firmly between the pipes to facilitate the cooling. Where it is not practicable to go deeper than 15 or 20 ft. without striking water, sandy soil or fine sand may be filled in around the air flues, and this wet once a week or oftener with cold water from the well to assist in lowering the temperature. Where this is done, galvanized iron flues should be used in place of drain tile to avoid percolation of water.

The air may be cooled in a similar way by leading the pipes into a cistern 12 or 15 ft. deep, which is filled with water. In such case the flues should have a water-tight connection, with a drum at top and bottom to prevent the entrance of water. The water may be changed from time to time as is necessary to keep it sufficiently cool.

In all the above cases a wind funnel is depended upon to supply a sufficient current of air. It is suggested that where practicable a small blower might be used with advantage, at least when the wind is very light.

The efficiency of these methods for cooling curing rooms depends very largely on the proper construction of the curing room. The author gives detailed directions for the construction of wooden and masonry above-ground curing rooms and of underground curing rooms. Commenting upon the expense of the form of construction recommended, the author says:

> "It should be kept in mind that two important points must be secured if anything like full effectiveness of the subearth duct is desired; (1) the walls must be so tight that the pressure and suction of the wind on the building does not drive out the cool air and leave in its place the warm air of the outside, and (2) the walls must be a sufficiently poor conductor to permit a relatively small movement of air through the subearth duct to remove all of the heat which penetrates the walls. The curing room is perfect in construction only when its walls are so tight that no air can enter the room except through the subearth duct, or at another specially provided opening which is used only when the air from the duct is too cool or too damp."

Dairying in Denmark in 1898, B. Boggild (*Tidsskr. Landökon, 1899, No. 3, pp. 133–163*).

Facts for consideration by dairy farmers, G. S. Thomson (*Jour. Agr. and Ind., South Australia, 2 (1899), No. 9, pp. 738–741*).—Urges the sterilization of utensils and the use of tuberculin.

The conformation of the dairy cow, A. M. Soule (*Hoard's Dairyman, 30 (1899), No. 19, p. 376*).—A popular address delivered before the Rural Science Club of the University of Tennessee.

The evolution of a rational system of cattle feeding, W. H. Jordan (*Vermont Dairymen's Assoc. Rpt. 1898, pp. 69–88*).—A popular paper on feeding dairy cows.

Twelfth Annual Report of the Iowa Dairy Commissioner (*Iowa State Dairy Com. Rpt. 1898, pp. 80+38*).—Text of the dairy laws of Iowa and various statistics and discussions relating to the dairy interests of the State.

A grade dairy herd, C. D. Smith (*Michigan Sta. Bul. 166, pp. 103–112, figs. 3*).—A financial account for one year is given of a grade dairy herd of 29 cows purchased to represent the average cows of southern Michigan and given uniformly good care and feed. The average production of milk per cow for the year was 7,009 lbs., the largest yield being 10,310 lbs. The average production of fat was 259.91 lbs., estimated as equivalent to 304.89 lbs. of butter. The net profit from the herd, not including the manure, amounted to $277.58. Notes are given on the record of individual cows, including tabulated data on the total milk and butter production of each.

The college herd, C. W. Burkett (*New Hampshire Sta. Bul. 59, pp. 192, 193*).—Brief statistics are given on the milk production of the college herd for the year ending October 30, 1898.

> "The herd has been equivalent to 309 milch cows and 94 dry cows for one month, and has produced 173,011 lbs. of milk and 9,376.89 lbs of butter, making an average monthly yield per head for 403 cows, 429 lbs. of milk and 23.3 lbs of butter, or 5,148 lbs. of milk and 280 lbs. of butter for the year."

Uniformity in the composition of milk, how to maintain it, C. B. Lane (*Trans. New York State Agr. Soc. 1897, pp. 252–259*).

How can we improve the factory milk-test system? J. L. Hills (*Vermont Dairymen's Assoc. Rpt. 1898, pp. 34–51*).—A popular article.

Water content of butter, E. H. Farrington (*Breeders' Gaz., 35 (1899), No. 20, p. 597*).—From the results of an investigation comparing the appearance and water content of salted and unsalted butter the author explains the apparent dryness of foreign butter as due to the absence of salt or the presence of only a small quantity.

Second report of the periodical Finnish butter exhibitions in Hangö (*Helsingfors, Finland, 1899, pp. 24*).—Four hundred and fifty tubs of butter from 175 different creameries were exhibited and judged during the year. The average water content of the butter was 12.3 per cent., the maximum being 16 per cent and the minimum

9.2 per cent. Of the tubs exhibited 83 leaked 10 or more grams of brine during storage, the average amount being 181 gm. and the maximum 985 gm. Of the 175 creameries participating in the butter exhibitions, 28 manufactured over 350 tubs per year; 71 made 150 to 350 tubs, and 76 less than 150 tubs; 165 were separator creameries, 3 used both separator and the ice-creaming system, and 7 used the latter system only; 29 pasteurized all their cream or milk and 4 used pasteurization to some extent. Fifty-eight creameries used pure culture starters.—F. W. WOLL.

VETERINARY SCIENCE AND PRACTICE.

Veterinary studies, A. T. NEALE (*Delaware Sta. Bul. 43, pp. 4-15*).—Brief notes are given on rabies, tetanus, and Texas fever. Numerous tests have been made by the station in cooperation with private veterinarians, of tuberculin in dairy herds. The tuberculin is considered practically infallible. A number of vaccination experiments were tried upon cattle suffering from anthrax with good results. The station is attempting to secure sterilization of the waste which escapes into the water and causes anthrax in certain localities.

Cerebro spinal meningitis in horses has been studied by the station. The question has been investigated as to whether the bunt in wheat and certain aspergilli and other fungus diseases upon food plants may cause cerebro spinal meningitis. The station hopes to be able to verify or disprove the theory that *Diplococcus intracellularis* is the specific germ of the disease.

Brief notes are given on the remedies for swine diseases as well as the serum treatment of those affections.

The condition of bovine tuberculosis in Europe, H. W. CONN (*Connecticut Storrs Sta. Bul. 19, pp. 12*).—According to statistics gathered from slaughterhouse inspection and from tuberculin tests, tuberculosis is rapidly spreading in European countries. It is much more prevalent in the northern countries of Europe than in the southern, and in herds which are closely housed than in those which are allowed to range freely. Fifty per cent of the cattle of northern Germany and Denmark are estimated to be tuberculous, and the cattle which were imported into Kiel from Denmark during 1897 were tuberculous to the extent of 66 per cent.

The tuberculosis of man and that of animals seems to be slightly different. The disease is readily transmitted by contagion from one animal to another, but it is becoming more and more doubtful in the minds of most scientists whether it is ever transmitted from man to animals, and the danger of transmission from animals to man is considered much less than was formerly believed.

In order to combat the disease, it is necessary in the first place to discover every case of tuberculosis, and for this purpose the use of tuberculin is considered essential. All animals which respond to the tuberculin test should be separated from the healthy animals, and must be cared for by separate attendants in order to prevent the disease from again breaking out in the healthy herd. Strict measures of this sort have been adopted in Denmark and carried out for a number of years with very promising results.

Tetanus, C. McCulloch (*Virginia Sta. Bul. 85, pp. 13–22, figs. 2*).—Tetanus is invariably produced by the introduction of the tetanus bacillus into a wound. The bacillus is said to be especially common in the dust of old floors, stables, and gardens. A detailed description is given of the appearance of the tetanus bacillus and an account of its biology and behavior in the incubator and upon nutrient media. Tetanus is particularly common in the horse, mule, sheep, and pig; less so in cows, calves, and lambs. There are two forms, acute and subacute, of which the acute is much more common. Death may occur in from 5 to 8 days and recovery is rare before the third week.

In the sheep and pig the mortality is about 100 per cent; in the horse, 80; in the ox, 50. The only affections with which tetanus is liable to be confounded are strychnin poisoning and cerebro spinal meningitis.

As a preventive treatment, careful antiseptic washing of wounds is recommended, and, whenever the disease develops, the use of the tetanus antitoxin is strongly advised.

Canine distemper, C. McCulloch (*Virginia Sta. Bul. 87, pp. 33–41*).—Canine distemper is caused by a micro-organism and is contagious. It is found in the dog, cat, fox, wolf, hyena, monkey, and has been found in the human family. The symptoms are depression, conjunctivitis of the eye, constipation or a fetid diarrhea, and a catarrh of the nasal passages. In weak subjects cerebral symptoms predominate and are characterized by stupefaction. The temperature usually rises, sometimes to 104° F. The mortality is from 50 to 60 per cent, and the prognosis in young animals is generally unfavorable.

Treatment should be symptomatic, to relieve the symptoms as they develop. Calomel in 1-grain doses 3 times a day gives good results. For the eye, ½ to 1 per cent solution of sulphate of zinc, or ½ to 2 per cent solution of nitrate of silver acts well. For the nervous symptoms, a sedative, such as bromid of soda 2½ drams or chloral hydrate 2 drams, gives favorable results. For the reduction of the fever, 2 grains of acetanilid may be blown into the mouth every 2 hours until the temperature begins to drop.

Report of the Royal Veterinary College for 1898, J. McFadyean (*Jour. Roy. Agr. Soc. England, 3. ser., 10 (1899), pt. 1, pp. 112–155*).—The report contains an account of work done by the laboratory of the Royal Veterinary College for the year 1898 on the following diseases: Glanders, anthrax, tuberculosis, swine fever (hog cholera), the contagious origin of warts, and milk fever. Some success has been had with vaccination according to the method introduced by Pasteur for anthrax. Statistics are given for tuberculin tests upon 4,379 cows, of which 31.7 per cent reacted. It was shown that warts, such as occur on the inside of the lips and on the tongue of dogs, may be transmitted by inocula-

tion. Good success is reported with the use of injections of iodid of potassium into the udders of cows suffering from milk fever.

Dehorning, E. P. NILES (*Virginia Sta. Bul. 84, pp. 12, figs. 6*).—A brief history is given of the dehorning methods practiced in different parts of the United States. The saw and horn clipper are not recommended on account of the unnecessary pain caused, and of the liability to subsequent trouble in the healing of the wound. The author recommends the ordinary caustic potash treatment, which is to be applied to young calves a few days after birth. Horns up to an inch or two in length can be removed by this method.

The gape worm of fowls; the earthworm, its immediate host, H. D. WALKER (*Franklinville, N. Y., 1897, pp. 30, pl. 1*).—The author relates a number of experiments in which the disease known as the gapes was produced in chickens by feeding them earthworms (*Lumbricus terrestris*). Chickens which were prevented from eating earthworms did not acquire the disease in any case. The larvæ of the gape worm (*Syngamus trachealis*) were found in the earthworm, and artificial cultures of the larvæ were made in the serum of blood.

For the prevention of the gapes in chickens, the author recommends the destruction of earthworms where the chickens are allowed to run by means of common salt or lime or with ashes in the soil.

On the cause of epizootic-catarrhal fever of dogs, P. JESS (*Berlin. Tierärztl. Wchnschr., 1899, No. 19, pp. 227–230, figs 3*).—Gives a description of the germ, with an account of the experimental inoculation of guinea pigs.

Rabies in England, M. E. LECLAINCHE (*Rev. Vet. Toulouse, 24 (1899), No. 6, pp. 358–362*).—Discusses the question of the relative efficiency of central and local authorities in controlling this disease.

Gangrenous mammitis of the goat, P. LEBLANC (*Jour. Med. Vet. et Zootech., 5. ser., 3 (1899), pp. 372–374*).—The cause was found to be a micrococcus.

Chronic arthritis of the stifle joint, CADIAC and MATRION (*Jour. Med. Vet. et Zootech., 5. ser., 3 (1899), pp. 257–262*).

Lung-worm disease of goats caused by Strongylus capillaris. A clinical, pathological, anatomical, and zoological study, M. SCHLEGEL (*Arch. Wiss. u. Prakt. Thierh., 25 (1899), No. 3–4, pp. 137–171, pls. 4*).

Bots, or worms, in the head of sheep or goats, D. HUTCHEON (*Agr. Jour. Cape Good Hope, 14 (1899), No. 10, pp. 667, 668*).

Lime and sulphur dip, A. G. DAVISON (*Agr. Jour. Cape Good Hope, 14 (1889), No. 10, pp. 644–651*).—From experiments the author considers this the most effective dip to be used against sheep-scab mite.

Easy method of dipping sheep, C. S. PLUMB (*Amer. Agr. (mid. ed.), 63 (1899), No. 24, p. 751*).—When the number of sheep to be dipped is small, a wagon box of double height was found to be a convenient place to allow the sheep to enter while dripping.

Saturnism in the horse, MOSSELMAN and HEBRANT (*Ann. Med. Vet., 48 (1899), pt. 1, pp. 13–21*).—An account of cases of lead poisoning in horses.

Diaphragmatic hernia in horses, PÉCUS (*Jour. Med. Vet. et Zootech., 5. ser., 3 (1899), pp. 262–271*).—A detailed account of clinical symptoms and of the autopsy.

The colic of horses from a diagnostic, genetic, and therapeutic view. The causes, prevention, and cure by means of extensive irrigation with certain fluids, DREYMANN (*Berlin. Tierärztl. Wchnschr., 1899, No. 21, pp. 251–255*).—The author had best success with enemas of from 20 to 50 liters of lukewarm water.

American horses and worm diseases, DR. LIEBENER (*Fühling's Landw. Ztg., 47 (1898), No. 19, pp. 736–739*).

Observations on hog cholera, G. GEROSA and G. BILLITZ (*Clin. Vet., 22 (1899), No. 16, pp. 181–185*).—A differentiation of hog cholera and swine plague, together with a description of the pathological anatomy of the disease and the methods of producing immunity.

Azoturia, O. G. Noack (*Jour. Comp. Med. and Vet. Arch., 20 (1899), No. 5, pp. 277-282*).—The disease is said to be caused by poisons which are liberated in the intestines. The treatment recommended is the giving of aloes, followed by a cholagogue and then bicarbonate of soda.

Directions for using Reindl's process for combating infectious abortion (*Ztschr. Landw. Kammer Sachsen, 1899, No. 2, pp. 43-47*).—The stalls are to be disinfected with ammoniacal soda in boiling water. The external parts of the animals are to be washed with the same soda solution.

Contagious vaginitis of the cow, Mathis (*Jour. Med. Vet. et Zootech., 5. ser., 3 (1899), pp. 198-202*).—A clinical record of a number of cases, with suggestions for antiseptic treatment.

Contributions to the treatment of parturient apoplexy according to Schmidt, O. Schwarzkopf (*Berlin. Tierärztl. Wchnschr., 1899, Mar. 30, pp. 156-158*).—Critical test of the iodid of potash treatment, with results which indicated it to be a doubtful success.

A contribution to statistics on the treatment of parturient apoplexy with iodid of potash, C. Saass (*Berlin. Tierärztl. Wchnschr., 1899, Mar. 30, pp. 155, 156*).—Sixty cases were treated with iodid of potash and 45 were cured.

The icteroid bacillus and its toxin, J. B. de Lacerda and A. Ramos (*Arch. Méd. Expér. et Anat. Path., Paris, 11 (1899), No. 3, pp. 378-398*).—Experiments with virulent cultures on rabbits and dogs gave positive results. A serum prepared by Sanarelli was not effective in preventing the disease.

The action of strychnin and chloral on animals affected with tetanus, Roger (*Compt. Rend. Soc. Biol. Paris, 11. ser., 1 (1899), No. 17, pp. 392-395*).—Chloral was not effective in stopping the contractions of tetanus.

An experimental study of tetanus, J. Binot (*Compt. Rend. Soc. Biol. Paris, 11. ser., 1 (1899), No. 17, pp. 409, 410*).—The fatal dose of toxin is found to vary according to the place and method of injection.

Vaccination against the foot and mouth disease, W. Flatten (*Berlin. Tierärztl. Wchnschr., 1899, No. 2, pp. 15, 16*).—The injection of seraphthin serum into the jugular vein produced positive though not well marked effect.

Foot and mouth disease, L. Anderson (*Maanedsskr. Dyrlaeger, 10 (1899), No. 10-11, pp. 385-438*).—Contains a detailed account of outbreaks of the disease in a number of herds. Tabulated statistics of the herds are given showing the number of animals in the herds, the number of cases of foot and mouth disease, and the number of deaths.

Some further remarks on red water, or Texas fever, A. Edington (*Proc. Roy. Soc. [London], 65 (1899), No. 414, pp. 111-114*).—Gives evidence of the communicability of Texas fever through blood from animals which have long recovered or from animals which were inoculated months before their blood was used.

Texas fever, or red water, Koch (*Agr. Jour. Cape Good Hope, 14 (1899), No. 10, pp. 658-667*).—Record of experiments in conferring immunity and destroying ticks

Studies on the cattle plague, Nicolle and Adil-Bey (*Ann. Inst. Pasteur, 13 (1899), No. 4, pp. 319-336*).—An account of experimental inoculation with virus and the production of immunity with a record of the experiments and charts of curves of temperatures.

My experience with blackleg vaccine, M. V. Byers (*Jour. Comp. Med. and Vet. Arch., 20 (1899), No. 4, pp. 219-221*).—Six hundred animals were vaccinated. The author prefers vaccination in the tail rather than in the ear or in the shoulder.

Rinderpest and tsetse, Koch (*Agr. Jour. Cape Good Hope, 14 (1899), No. 27, pp. 552-560, figs. 2*).—Inoculation with bile followed by virulent blood is reported as being a very successful means for combating rinderpest. The disease is said to be rapidly decreasing in South Africa.

The tsetse or surra disease is confined to cattle, horses, elephants, and dogs. The parasite is of the trypanosoma type and is carried from animal to animal by the tsetse fly.

Further investigations on immunity to splenic fever, G. SOBERNHEIM (*Ztschr. Hyg. u. Infectionskrank., 31 (1899), No. 1, pp. 89–132*).

Experiences in vaccination against splenic fever according to Pasteur, BARKOW (*Deut. Tierärzlt. Wchnschr., 7 (1899), No. 17, pp. 153, 154*).—Of 330 animals vaccinated, only 1 died.

Contribution to the treatment of actinomycosis with iodid of potash, REMY (*Deut. Tierärztl. Wchnschr., 7 (1899), No. 19, pp. 169–172*).—A record of 8 cases of actinomycosis. Potassium iodid was used in all cases and was shown to be a specific even in advanced stages of this disease.

A bibliographical index of works published on the subject of tuberculosis in 1899 (*App. Rev. Tuberculose, Paris, 6 (1899), No. 1, pp. 12*).

Phagocytosis in the pigeon with reference to the tubercle bacillus of birds and of man. A contribution to the study of natural immunity, DEMBINSKI (*Ann. Inst. Pasteur, 13 (1899), No. 5, pp. 426–434*).—The phagocytic reaction in the pigeon varies, depending upon whether the bird has been inoculated with the bacillus of birds or of man. After being inoculated with the bacillus of birds phagocytosis is very active, and three stages can be distinguished—polynuclear, mixed, and mononuclear. After inoculation with the bacillus of man, polynuclear and mononuclear leucocytes appear at the same time.

Several cases of tuberculosis in cattle with accompanying meningitis, HAMOIR (*Ann. Méd. Vét., 48 (1899), pts. 2, pp. 75–88; 3, pp. 136–142; 4, pp. 190–199*).—Calls attention to the necessity of observing the nervous symptoms in this sort of tuberculosis. The disease is said to be accompanied frequently by meningitis of the spinal cord or of the brain, or both. The symptoms are unequivocal and characteristic.

Contribution to the question of the infectiousness of the milk of tuberculous cows and on the value of the tuberculin inoculation, L. RABINOWITSCH and W. KEMPNER (*Ztschr. Hyg. u. Infectionskrank., 31 (1899), No. 1, pp. 137–15.*).

Tuberculosis in a goat, P. SCHLATHÖLTER (*Deut. Tierärztl. Wchnschr., 7 (1899), No. 20, pp. 179*).—The goat was reared on cow's milk.

A case of fœtal tuberculosis in a calf, M. P. RAVENEL (*Vet. Jour., 48 (1899), No. 288, pp. 417, 418*).

On tuberculous meat and milk, J. NIVEN (*Jour. Sanit. Inst., 19 (1898), No. 4, pp. 534–554*).—Recommends the creation of a veterinary public health service, greater facilities for inspection of outside cows, and prompt notification of disease.

On traumatism and tuberculosis, LANNELONGUE and ACHARD (*Compt. Rend. Acad. Sci. Paris, 128 (1899), No. 18, pp. 1075–1078*).—The tubercle bacillus placed in wounds did not bring about an infection.

Tuberculosis and variola, P. A. LOP (*Rev. Tuberculose, Paris, 6 (1899), No. 1, pp. 28–44*).—Variola is shown to be a predisposing cause to tuberculosis. Variolous parents are apt to have tuberculous offspring.

Tuberculosis, N. ROUCHÉS (*Jour. Agricole [Paris], 10 (1899), No. 110, pp. 79–81*).—The disease is reported as being rare in the Department of Seine, only 5 out of every 100 cows responding to the test.

Tuberculous cattle (*Agr. Student, 5 (1899), No. 9, pp. 174, 175*).—A record of tuberculin tests with 13 cases, and notes on post-mortem conditions.

The application of the tuberculin test in cattle, OSTERTAG (*Mitt. Deut. Landw. Gesell., 1898, Feb. pp. 4*).—Recommends further and more stringent laws for the thorough suppression of tuberculosis.

Tuberculosis among cattle and means of combating it, O. E. STENSTRÖM (*Meddel. K. Landtbr. Styr., 1899, No. 54, pp. 40*).—A general account of the nature of tuberculosis; the means by which it is transmitted from animal to animal, or from animals to man, and *vice versa;* and directions for using the tuberculin test, together with a discussion of its value.

Tuberculosis and methods of fighting it, V. R. I. CROESEN (*Orgaan Ver. Oudleer. Rijks. Landbouwschool, 11 (1899), No. 131, pp. 89–94*).—Gives a discussion of the nature and symptoms of the disease. For controlling the disease, it is urged that all cattle be tested with tuberculin, that the healthy be strictly separated from the diseased, and that the usual precautions be taken to prevent contagion from one animal to another.

Tuberculin testing and combating tuberculosis among cattle, A. Eber (*Tuberkulinprobe und Tuberkulosebekämpfung beim Rinde. Berlin: Paul Parey, 1898, pp. 84*).—This work gives a discussion on the significance of bovine tuberculosis, the diagnostic value of tuberculin, the effects of tuberculin upon cattle, and the prevalence of tuberculosis among cattle according to the results gained from tuberculin tests.

Treatment of tuberculosis by subcutaneous injections of artificial serum in small doses, M. G. Morard (*Compt. Rend. Soc. Biol. Paris, 11. ser., 1 (1899), No. 15, pp. 335, 336*).—Saline serum injections in small doses checked the disease in about one-half the cases. The dose which operated most favorbly was one of from 2 to 3 cc. per day.

Tuberculin and its use, G. J. Bernier (*Rev. Facult. Agron. y Vet. La Plata, 4 (1898), No. 3, pp. 77-93, pl. 1*).—A discussion of the nature and value of tuberculin and directions for its use in making tests for tuberculosis.

Investigations with tuberculin (*Meddel. K. Landtbr. Styr., 1898, No. 48, pp. 258, 259*).—Notes on tuberculin tests with 13,768 animals.

Combating tuberculosis in domesticated animals, G. Regner (*Meddel. K. Landtbr. Styr., 1899, No. 55, pp. 29*).—A dialogue in the form of questions and answers concerning practical methods of recognizing tuberculosis and of applying the tuberculin test for separating diseased animals from healthy ones.

Tuberculosis in man and beast, H. Maxwell (*Nineteenth Century, 1898, Dec.; abs. in Rev. of Reviews, 1899, Jan., pp. 101, 102*).—The author calls attention to the dangers of infection from the milk of tuberculous cows.

Bacteriolytic enzyms as the cause of acquired immunity and the cure of infectious diseases by means of them, R. Emmerich and O. Löw (*Ztschr. Hyg. u. Infectionskrank., 31 (1899), No. 1, pp. 65*).—Enzyms are produced during the growth of bacteria, which check the growth of the latter. In several cases an enzym is produced which destroys the activity of other species of pathogenic bacteria as well as of that species which produced the enzym in question.

A contribution to the knowledge of the infectious diseases of animals and man which are caused by anærobic bacteria, E. von Hibler (*Centbl. Bakt. u. Par., 1. Abt., 25 (1899), No. 17, pp. 593-613*).—Gives biological notes on certain anærobic bacteria which are distinguished from the *Œdema bacillus* and the *Tetanus bacillus.*

Extracts from the report on the work of the Kharkof Bacteriological Station for 1898 (*Selsk. Khoz. i Lyesov., 192 (1899), Mar., pp. 553-556*).—Gives a brief account of the activity of the station along various bacteriological lines.

An experimental study on the effect of toxins and antitoxins introduced into the digestive canal of animals, G. Carriere (*Ann. Inst. Pasteur. 13 (1899), No. 5, pp. 435-443*).—Ptyalin had no effect on the activity of antitoxic serums. The artificial gastric juice did not change the antitoxic serum, but had a slight effect on antivenom serum. The bile of cattle had no modifying effect on the antitoxins which were studied. Pancreatin changed them very much, and even destroyed them. The intestinal micro-organisms also had a strong modifying effect upon them.

Notes on Bacillus anthracis similis, J. McFarland (*Centbl. Bakt. u. Par., 1. Abt., 24 (1898), p. 566; abs. in Jour. Roy. Micros. Soc. [London], 1899, No. 1, p. 72*).—An organism isolated from the pus of an abscess, the colonies of which were identical with *B. anthracis,* is described. It is a large bacillus with slightly rounded ends, and forms long filaments with transverse septa. In bouillon cultures 4 days old there were no spores, but in agar cultures 3 weeks old they were exceedingly abundant. In agar and gelatin cultures the organisms are similar to those of *B. anthracis.* The growth on the potato is luxuriant. On bouillon there forms a surface mycodern and a sediment from constantly precipitating bacillary masses. *B. anthracis similis* is said to be nonpathogenic to guinea pigs, mice, or rabbits.

Report of the bacteriological station of the Kazan Veterinary Institute for 1897 (*Kazan, 1898; rev. in Selsk. Khoz. i Lyesov., 191 (1898), Nov., p. 480*).

Twenty-fourth annual report of the government institution for the cultivation of vaccine virus in the government veterinary school at Utrecht, A. W. H. WIRTZ (*Vier en twintigstejaarverslag van de Rijksinrichting tot kweeking van koepokstof. Utrecht: J. Van Druten, 1897, pp. 32*).—The paper gives a record of a number of experiments made on the cultivation of vaccine virus in calves. Tables are given which show the effect upon the calves of the inoculation, and the method of obtaining a preparation of the vaccine from the calves is explained.

Annual report on the literature in the field of veterinary medicine, ELLENBERGER, SCHÜTZ, and BAUM (*Jahresbericht über die Leistungen auf dem Gebiete der Veterinär-Medicin. Berlin: August Hirschwald, 1898, pp. 240*).—A classified bibliography of books, pamphlets, and periodical articles on the subject of veterinary medicine in all its branches.

AGRICULTURAL ENGINEERING.

Proceedings of the seventh annual session of the National Irrigation Congress, held at Cheyenne, Wyoming, September 1-3, 1898 (*Cheyenne: Business Men's Club of Cheyenne, 1899, pp. 159, pls. 4*).—This report, compiled by R. C. Morris, contains discussions and papers on a variety of topics, including among others storage reservoirs, obstacles to settlement of the arid region, national legislation on the reclamation of arid lands, successes and failures in canal building, and other enterprises; the measurement of streams; what Congress is doing for irrigation; national forest reserves; cession of arid lands in connection with irrigation; sociological questions connected with irrigation; laws and regulations to promote the best use of water in time of scarcity; irrigation work of the agricultural experiment stations, etc.

The resolutions adopted contain the following, which is of especial interest to the Department and the experiment stations:

> "We cordially approve the beginning of an investigation of these problems by the Department of Agriculture. This Department can, by continuing and extending this work, do much to assist the creation of homes in what are now arid wastes, in augmenting our national wealth, and in promoting the prosperity and contentment of the farmers of this country, both in the East and West. . . .
>
> "We favor the creation, in the Department of Agriculture, of a Division of Irrigation, to carry out the work outlined above, and the making by Congress of liberal appropriations for its support.
>
> "We express our cordial appreciation of the value of irrigation investigations already made by several of the agricultural experiment stations within the arid States. The value of the results already secured warrants an extension of this work, and we recommend that the experiment stations of the arid States give increased attention to this class of problems and a liberal support to those engaged in these investigations."

Experiments with windmills, T. O. PERRY (*Water Supply and Irrig. Papers, U. S. Geol. Survey, No. 20, pp. 98, pls. 12, figs. 39*).—This is an account of dynamometric experiments carried out during the years 1882 and 1883 for the United States Wind Engine and Pump Company of Batavia, Illinois, with a detailed discussion of the results as applied to the construction of windmills of the highest efficiency. "As a result of these experiments radical changes and improvements were made in the windmills. As a matter of business policy the company did not desire that the results of these tests should be made known for some years. After the expiration of a certain time, however, the data have been placed at the disposal of the public through the kindness of the officers of the company and the efforts of Mr. Perry. Although as the result of this work great changes have been made in windmills, many of the suggestions made have not yet been put into practice and may serve as a foundation for further work along this line. The importance of the windmill as a means of utilizing the water resources of a part of the country is so great that all available information on the subject should be diffused and brought to the attention of persons who can make use of the facts."

An earlier paper of this series giving an account of experiments with windmills and discussing their value for irrigation has already been noted (E. S. R., 9, p. 796).

Operations at river stations, 1897 (*Water Supply and Irrig. Papers, U. S. Geol. Survey, Nos. 15, 16, pp. 200*).—Brief descriptions of the river stations at which work was carried on by the Division of Hydrography of the U. S. Geological Survey during 1897, together with tables of daily height.

Irrigation near Bakersfield, California, C. E. GRUNSKY (*Water Supply and Irrig. Papers, U. S. Geol. Survey, No. 17, pp. 91, pls. 11, figs. 21*).—"This paper is the first of three relating to San Joaquin Valley, the others being entitled, respectively, Irrigation near Fresno, California, and Irrigation near Merced, California. (See below.)

"In this, the first paper, some space has been devoted to a general description of San Joaquin Valley as a whole, and of the irrigation districts which have been organized within it, the history of these being briefly outlined. There is also added a description of the methods of irrigation commonly employed, as this has especial interest in connection with the more detailed statements regarding the individual canals and ditches. Following these more general matters, Kern River is taken up, its drainage basin discussed, and each of the numerous systems of water supply depending upon the river is described at some length. Then the creeks lying to the north, Poso and Deer, are described, as well as Tule River.

"Although a relatively high degree of development of irrigation has been reached in this part of the arid region, yet the results are far below the possibilities."

Irrigation near Fresno, California, C. E. GRUNSKY (*Water Supply and Irrig. Papers, U. S. Geol. Survey, No. 18, pp. 94, pls. 14, figs. 21*).—This paper, which is the second of a series of three devoted to irrigation in the San Joaquin Valley, "relates mainly to the irrigation systems deriving their water supply from Kaweah and Kings rivers and covering the agricultural lands on the east side of San Joaquin Valley between Visalia and Fresno."

Irrigation near Merced, California, C. E. GRUNSKY (*Water Supply and Irrig. Papers, U. S. Geol. Survey, No. 19, pp. 60, pls. 11, figs. 14*).—"This paper describes the irrigation systems deriving their water supply from San Joaquin, Chowchilla, Merced, Tuolumne, Stanislaus, and Mokelumne rivers."

Stream measurements in 1897, F. H. NEWELL (*Nineteenth An. Rpt. U. S. Geol. Survey, 1897–98, pt. 4, pp. 632, pls. 70, figs. 207*).—This is a detailed account of stream measurements in all parts of the United States, the main results of which have already been reported in Water Supply and Irrigation Papers 15 and 16 of the U. S. Geological Survey. (See above.) The methods pursued in these measurements are described, and some account is given of the character of the various river or drainage basins and of the present and prospective use of the different streams. The data "are given numerically by months, the daily changes being graphically expressed in diagrams."

Preliminary report of an investigation of rivers and deep ground waters of Ohio as sources of public water supply (*Cleveland: J. B. Savage Press, 1898, pp. 259*).—The investigations were made under the auspices of the State Board of Health.

State irrigating canals (*Montana Bureau Agr. Labor and Ind. Rpt. 1898, pp. 64–76*).

Tests of pumps and water lifts, O. P. HOOD (*Water Supply and Irrig. Papers, U. S. Geol. Survey, No. 14, pp. 91, pl. 1, figs. 58*).—This is an account of tests made at the State Agricultural College, Manhattan, Kansas, of the efficiency of various pumps and water lifts and of the various sources of frictional loss, with a discussion of the results.

Steel tracks for wagon roads (*Amer. Agr.* (*mid. ed.*), *63* (*1899*), *No. 21, p. 670*).

Sprinkling roads with oil (*Country Gent., 64* (*1899*), *No. 2420, p. 465*).

STATISTICS—MISCELLANEOUS.

Tenth Annual Report of New Hampshire Station, 1898 (*New Hampshire Sta. Bul. 59, pp. 169–219*).—This contains a financial statement for the fiscal year ending June 30, 1898; a subject list of the publications issued by the station since its organization; and reports of the director, vice-director, agriculturist, horticulturist, bacteriologist, entomologist, and meteorologist, parts of which are noted elsewhere.

Eleventh Annual Report of Tennessee Station, 1898 (*Tennessee Sta. Rpt. 1898, pp. 5–17, 28*).—This contains a financial statement for the fiscal year ending June 30, 1898; reports of the secretary, chemist, horticulturist, botanist, entomologist, and librarian, setting forth the station work for the year, and a brief description of a new barn built at the station.

Report of Virginia Station for 1898 (*Virginia Sta. Rpt. 1898, pp. 12*).—This includes brief reports by the director and heads of departments on the station work for the year, and a financial statement for the fiscal year ending June 30, 1898.

Report of the Agricultural Department of Sweden for 1897 (*Meddel. K. Landtbr. Styr., 1898, No. 48, pp. 424*).—The report is made up of the annual reports on meteorology and crops in Sweden during 1897; reports of county agricultural societies, agricultural educational institutions, the various public agricultural functionaries, tuberculin investigations, the piscicultural and entomological institutes, the chemical and seed control stations, and the chemical plant biological station at Luleå.

According to the report of the chemical-control stations, 51,859 samples, of which 41,374 were dairy products, were examined at the 8 stations in operation during the year. The 18 seed control stations in operation during 1897 made 10,333 seed examinations, the average results of which are given.—F. W. WOLL.

Reports of the Ploty Agricultural Experiment Station (*Compt. Rend. Ann. Sta. Agron. Ploty, 1895, pp. 24; 1896, pp. 124, figs. 2, charts 3*).—This station was organized in 1894 by Prince Paul Troubetskoi. It is situated in the government of Podolia, southern Russia, on the chernozem soils, where the climate is entirely continental. The station is equipped with an agricultural laboratory, a meteorological station, and experimental fields.

These, the first two, reports record analyses of soils and water, experiments with fertilizers and methods of culture on various crops, experiments with grapes, and meteorological observations, especially as related to the growth of crops.

Agriculture in Denmark in connection with the general development of that country, N. A. KRUKOV (*St. Petersburg: Department of Agriculture of the Ministry of Agriculture and Imperial Domains, 1899, pp. XII + 327; rev. in Selsk. Khoz. i Lyesov., 192* (*1899*), *Mar., pp. 707, 708*).—According to the author the high degree of development of agriculture which Denmark has attained, in spite of the unfavorable natural conditions, is due, on the one hand, to the extensive development of mutual-aid associations of farmers, and, on the other, to Government measures, such as the maintenance of a considerable staff of specialists in various branches of agriculture, the financial assistance to the agricultural associations, etc. One of the essential features of all these measures is the support and the intellectual development of the small farmers, which constitute a large proportion of the Danish landowners.—P. FIREMAN.

Report of the Spalato (Dalmatia) Agricultural Chemical Experiment Station, 1894–1898, F. GVOZDENOVIĆ (*Ber. Thätigkeit Landwirth.-Chem. Versuchs. in Spalato, pp. 32; separate from Ztschr. Landw. Versuchw. Oesterr., 2 (1899), No. 3*).—This is a summary statement of the work of the station from its organization until December, 1898.

Third annual report of the Ploti Agricultural Experiment Station, in the government of Podolsk, 1897 (*Odessa, 1898, pp. 158; rev. in Selsk. Khoz. i Lyesov., 192 (1899), Feb., pp. 473, 474*).

On horticultural stations, P. NÖVIK (*Tidsskr. Norske Landbr., 6 (1899), No. 4, pp. 145–173*).

The asylum farm of Bois de Cery (GAVILLET, BAUVERD, and GILLIÉRON-DUBOUX (*La Ferme de l'Asile du Bois de Cery. Lausanne: A. Borgeaud, 1899, pp. 68, pls. 10, figs. 21*).—A description of an asylum farm and its management. The farm is located near Lausanne, in Switzerland.

Fourth annual report of the superintendent of farmers' institutes of Ontario, 1897–98, F. W. HODSON (*pp. XIV, App., pp. 440*).—This includes a brief summary of the work of the year; a list of institute officers; data showing the membership of local farmers' institutes, meetings held, attendance, receipts and expenditures; a report of the women's institute at Saltfleet, including a financial statement and text of constitution and by-laws; and an appendix containing 141 selected papers read at different institutes during the year; a review of investigations conducted at various European and American experiment stations, and reports by the directors of Connecticut Storrs, North Dakota, Illinois, Kansas, Maine, Michigan, Massachusetts Hatch, New Jersey, Nebraska, Ohio, Rhode Island, and Washington stations. The report showed that during the year 658 meetings were held, 3,270 addresses delivered, and 126,094 persons attended the meetings.

Review of the Polish agricultural literature for 1897, F. LUBANSKI (*Selsk. Khoz. i Lyesov., 192 (1899), Mar., pp. 681–693*).

Suggestions to auxiliary clubs (*South Carolina Sta. Bul. 39, pp. 8*).—Brief popular suggestions for conducting experiments with fertilizers and for testing dairy cows.

Index to preceding bulletins (*Virginia Sta. Bul. 83, pp. 133–140*).—This is an index to Bulletins 1–82 of the station.

Trade of the Philippine Islands, F. H. HITCHCOCK (*U. S. Dept. Agr., Section of Foreign Markets Bul. 14, pp. 160*).—A statistical review of the foreign trade of the Philippine Islands, showing the nature, quantity, and value of the principal imports and exports. The total imports in 1894 amounted to $14,250,717 and the exports to $16,541,842. The principal agricultural imports are wines, rice, wheat flour, and canned goods. The principal exports are manila hemp, sugar, copra or cocoanut kernels, leaf tobacco, and cigars and cigarettes. The quantity of manila hemp exported in 1897 was 112,786 tons, and of sugar 152,687,620 lbs., the two products amounting to more than 75 per cent of the total export valuation of the islands. During the years 1892 and 1893 manila hemp and sugar were sent chiefly to the United Kingdom and the United States, and tobacco and coffee to Spain. Detailed statistics are given on the trade of the Philippines by countries. Among the countries receiving imports from the islands the United Kingdom ranks first, the United States second, and Spain third for the period from 1887 to 1896. As regards exports to the Philippines, Spain, the United Kingdom, and Germany rank in the order mentioned for the years 1892 to 1896, inclusive.

NOTES.

Arkansas Station.—W. G. Vincenheller, a professional orchardist, and for the past six years State commissioner of agriculture, has been appointed pomologist and institute worker. The experimental work of the horticulturist will be with truck crops and small fruits.

Colorado College and Station.—The following new members have been appointed on the governing board: P. A. Amiss, of Pruden, and Harlan Thomas, of Denver, *vice* A. S. Benson and M. A. Leddy, retired; and Jesse Harris, of Fort Collins, *vice* J. J. Ryan, deceased. P. F. Sharp, of Pueblo, has been elected president of the board, *vice* A. L. Kellogg, and A. M. Hawley, secretary, *vice* J. E. Du Bois, deceased. The executive committee, which has charge of matters pertaining to the station, consists of the president of the board, P. F. Sharp, B. F. Rockafellow, of Canon City; J. L. Chatfield, of Gypsum; P. A. Amiss, and Jesse Harris. Henceforth the directorship of the station is to be separated from the presidency of the college. B. O. Aylesworth, of Denver, former president of Drake University, Iowa, has been elected president, and L. G. Carpenter, director.

Illinois Station.—The chemist of the station, C. G. Hopkins, has been granted leave of absence for a year, to be devoted chiefly to the study of agricultural chemistry in Germany. L. H. Smith, who has been associated with the department during the past four years, will be left in charge as assistant chemist.

Indiana Station.—A new piggery, designed especially for feeding purposes, has been erected. The first floor is of cement, and all partitions and woodwork, excepting a limited number of posts, are clear of the floor by about an inch and a half, so that the whole floor can be flushed with water and kept clean. Steel troughs for feeding are placed immediately over the gutter in front of the pens. Ample provision is made for storing different kinds of grain or feed in the second story. The building contains a small hospital room, bedroom for watchman, scales, stoves for heating water, etc., and is provided with ventilating chutes. It is not intended for housing the pigs at night except in special cases, and to meet such cases 4 special pens are connected directly with sleeping rooms. Ordinarily the pigs sleep in small houses placed in yards or fields adjoining the feeding house.

Iowa College and Station.—John J. Repp has been elected veterinarian of the station, *vice* M. Stalker. It has been decided to appoint an additional assistant in animal husbandry to meet the increased demands in that branch of the college and station work. The number of students in the four years' course in agriculture has reached 165, having more than doubled during the past year. Great need is felt of increased facilities for instruction and investigation.

Kansas Station.—The governing board and the station staff are at present constituted as follows: Board of regents—President, E. T. Fairchild, of Manhattan; vice-president, J. S. McDowell, of Smith Center; treasurer, W. T. Yoe, of Independence; William Hunter, of Blue Rapids; Mrs. Susan J. St. John, of Olathe; Carl Vrooman, of Parsons; J. M. Satterthwaite, of Douglass. Station staff—J. T. Willard, chemist and chairman of station council; A. S. Hitchcock, botanist; Paul Fischer, veterinarian; H. M. Cottrell, agriculturist; E. A. Popenoe, entomologist and horticulturist; Lorena E. Clemons, secretary; D. H. Otis, assistant in dairying; P. J. Parrott, assistant entomologist; R. W. Clothier, assistant chemist; J. M. Westgate, assistant botanist; R. B. Mitchell, assistant in veterinary department; Albert Dickens, assistant horticulturist; J. G. Haney, assistant in feeding and field work.

MINNESOTA STATION.—Thomas Wilson, of St. Paul, has been elected a member of the governing board of the station, *vice* M. R. Todd.

NEBRASKA STATION.—T. L. Lyon has been made acting director of the station, and William H. Tuck has been promoted to be laboratory assistant in animal pathology.

NEW HAMPSHIRE COLLEGE AND STATION.—At the last meeting of the board of trustees Frederick Symmes Johnston, of the Ohio State University, was elected assistant professor of agriculture and assistant agriculturist at the college and station, and will give special attention to the work in agronomy and soil physics.

NORTH CAROLINA COLLEGE AND STATION.—George T. Winston, formerly president of the universities of Texas and of North Carolina, has been elected president of the college and director of the station. W. A. Withers, who has been acting director of the station for the past two years, will in future devote his entire time to the chemical work of the college and station. B. Irby, who formerly held the chair of agriculture in the college, becomes professor of agriculture and agriculturist, succeeding F. E. Emery. C. W. Hyams, assistant botanist, has also been made assistant entomologist. Cooper Curtice has severed his connection with the station to accept the position of veterinarian to the State board of agriculture. On July 1, 1899, in accordance with the act of the general assembly, the State board of agriculture assumed direct supervision of the fertilizer control, and B. W. Kilgore, formerly of the Mississippi College, has been appointed State chemist in charge of this work. The members of what had been the fertilizer control division of the station, A. W. Blair, C. B. Williams, C. D. Harris, F. G. Kelly, W. G. Haywood, H. E. King, and Miss M. S. Birdsong, were transferred to the State board of agriculture. The executive work of the North Carolina commission for controlling crop pests has been assigned to the commissioner of agriculture instead of the director of the station. The station is not charged at present, therefore, with police work of any character.

NORTH DAKOTA COLLEGE AND STATION.—A combined sheep and pig frame barn, 36 by 48 ft., one and one-half stories, is about completed, as is also an addition to the mechanical building, 22 by 36 ft., for instruction in blacksmithing. A department of steam engineering has been established in connection with the mechanical course, intended more particularly to accommodate young men desirous of operating steam traction engines. Several additions have been made to the faculty of the college. C. H. Mallarian has been elected instructor in German, French, and philosophy; F. V. Warren, instructor in steam engineering and mathematics; Albert T. Mills, instructor in history and civil government; L. R. Waldron, assistant in the botanical laboratory, *vice* Merton Field, resigned, and R. A. Shattuck, accountant and instructor in bookkeeping, *vice* P. W. Farnham.

OHIO STATION.—Luther M. Strong, of Kenton, has been appointed a member of the board of control, *vice* S. H. Ellis, whose fourth term of continuous service on this board has expired.

OKLAHOMA STATION.—F. C. Burtis, of the Kansas Station, has been appointed agriculturist and horticulturist of the station.

VIRGINIA COLLEGE AND STATION.—D. M. Cloyd has been appointed a member of the board of control in place of S. H. Graves. A. T. Eskridge, assistant chemist of the station, has been transferred to the college staff. A new barn, designed in part for station use, has been ordered by the college at a cost of $5,000. The college has completed a new cannery and cider and vinegar factory, which will also be used by the station for experimental purposes.

WASHINGTON COLLEGE AND STATION.—E. E. Elliott has been elected assistant in agriculture in the college and station and superintendent of the farm

EXPERIMENT STATION RECORD.

VOL. XI. No. 3.

The recent death of Henry Lêvêque de Vilmorin marks the passing of an eminent exponent of plant breeding, whose family for three generations has been prominently associated with the improvement of cultivated plants. Grandfather, father, and son were ardent students of plant breeding, and to their efforts are due many highly developed varieties of vegetables, grains, and ornamentals which to-day are regarded as standards. Their investigations taught us much regarding the possibilities of plant breeding and selection from a scientific as well as a practical point of view, and furnished important contributions on the methods of conducting such work. Acting upon the well-founded theory that plants, like animals, are "plastic," and can be profoundly influenced through systematic selection and breeding, they pursued their labors with a thorough, scientific spirit and an untiring energy that are worthy of emulation.

Prominent among their originations are varieties of sugar beets, carrots, wheats, and potatoes, as well as many ornamentals. The improvement of the sugar beet, which has made that crop one of such great commercial importance, is very largely due to the efforts begun by Louis de Vilmorin and continued by his son. The latter was also greatly interested in wheats, and two cross-bred varieties, Datel and Lamed, are rapidly gaining favor, not only in France but elsewhere.

In 1893 Henry de Vilmorin visited this country and presided over some of the deliberations of the Horticultural Congress held in connection with the World's Columbian Exposition. He took a prominent part in the Hybridization Conference held during the past summer in London, at which time he announced the successful hybridization of an annual and a perennial poppy, explaining the peculiarities of the plants and exhibiting water-color sketches of the parent plants and the results of the crossing.

Although not a prolific writer, he contributed the results of his investigations and observations to a number of journals, and prepared several more elaborate works. A recent article by him in this journal gives an excellent description of the methods of selection and its effects on cultivated plants. That he did not write more is possibly due to the fact that he was at the head of the seed firm of Vilmorin-Andrieux & Co., the largest establishment of its kind in France, and gave personal attention to much of their work in the improvement of varieties. He was a member of a large number of learned and scientific societies, and had been decorated a number of times by various European governments in honor of his services in the promotion of agricultural and horticultural science. In 1896 he was the recipient of the Veitch medal in recognition of his contributions to horticulture.

With the greater specialization in the field of agriculture there is evidence of a growing interest among the experiment stations of this country in the work of selection and plant breeding. It seems not unlikely that eventually this may in large measure replace the indiscriminate testing of varieties, for which there has been such a popular demand. It is perhaps a quite natural outgrowth of variety testing, for its aims are similar and in a measure it anticipates the work of seedsmen and nurserymen.

Scientific selection is the refining and systematizing of a process which in one form or another has been going on since the beginning of cultivation, and which is practiced by a few farmers in nearly every neighborhood. Combined with plant breeding, its possibilities are almost unlimited, and it affords opportunity for the exercise of the qualities which characterize the trained experimenter. It requires a thorough knowledge of the plant and the conditions of its growth, and the ability to discriminate between that which is inherently good in a plant and that which owes its excellence to superior environment.

The records of the experiment stations already furnish many striking examples of the benefits of selection and breeding in improved quality, yield, or hardiness of a number of agricultural plants. Probably the most extensive work of this kind at any American station is that conducted by Professor Hays in Minnesota. A recent bulletin of that station gives the results of ten years' experimentation in breeding wheats, and describes in an interesting manner the methods which are employed. In the course of this work many crosses were made, the object being to first induce as great variation as possible, after which desirable varieties were obtained by systematic selection. Increased production was the chief desideratum, and varieties were obtained that were from 10 to 25 per cent more prolific than the originals. Similar experiments are in progress with corn, barley, flax, beans, field peas, millets, and other forage crops. At the West Virginia Station the improvement of timothy by selection has been pursued for a number of years, and some very distinct and promising varieties have been obtained. A number of stations are investigating the possibility of increasing the protein content of maize by selection, and sugar-beet breeding has become a popular line of work. Sugar-cane selection has been carried on with very marked success by the Louisiana Stations for a number of years, and promising results in improving sorghum by selection have been secured by the Delaware Station. The breeding of upland cotton has been conducted at a number of stations in the South, and the very careful experiments with sea-island cotton are tolerably familiar.

One thing must always be kept in mind by the plant breeder, and that is the ideal plant for which he is striving. If hardiness is sought, everything must be subordinated to this idea. If greater productivity is desired, that, too, must always be preeminent in every selection. Sometimes selections may be made for more than one point of excellence, but certain antagonisms in plant breeding have been pointed out that at present seem unsurmountable. For example, extreme earliness and great productivity are not to be looked for in the same plant. Great size of fruit, flower, or other organ, and extreme fecundity are not usually attained in one selection.

The unit of every selection should be the individual plant. Whenever average individuals are selected average products may be expected. Selection based on the individual may be slower in bringing results, but in no other way can the ability of a plant to transmit its desirable qualities be so surely established.

That plants may, on the whole, degenerate under selection is not generally understood, but there is abundant evidence in proof of this. A careful study of all the characteristics of the selected plant is necessary to success. It not infrequently happens in improper selection that a new variety is produced which is desirable in many ways, but that in the process of its selection undesirable traits are developed that more than counterbalance all that has been gained. A cereal of increased productivity may be bred but so liable to fungus attacks as to be worthless when sown as a crop. Hardiness may be secured at the expense of quality. Flavor and color of fruit may be secured at the sacrifice of some equally desirable attribute. The intelligent plant breeder will consider all of these factors before announcing a new variety.

In every selection adaptation to environment must be considered. What may be valuable in one region may be worthless in another. In testing new varieties the conditions under which they were produced must be considered. This greatly restricts the range of operation, while multiplying the opportunities for such work. Greater success is likely to accrue from experiments in which an improved variety for a restricted range is sought rather than one of wider adaptation. It is quite possible that the variety best adapted for a given region may ultimately be found to be one bred in that region.

There is no more attractive field for work in horticulture than in plant breeding, and yet this is a subject which has attracted the attention of but few station horticulturists. The results secured by some of the leading originators show the wonderful possibilities in this line. There is a demand for work of this character, as evidenced, for instance, by discussion at the recent meeting of the American Pomological Society. It is believed that at least a portion of the present extensive testing of varieties might well be replaced by experiments directed toward the improvement of fruits and vegetables.

CONVENTION OF ASSOCIATION OF OFFICIAL AGRICULTURAL CHEMISTS, 1899.

E. W. ALLEN, Ph D.,
Office of Experiment Stations

The sixteenth annual convention of the Association of Official Agricultural Chemists was held at San Francisco, Cal., July 5–7, 1899. The convention was held in conjunction with the convention of the Association of American Agricultural Colleges and Experiment Stations, but its sessions were all separate except one. The sessions were held in the assembly hall of the Mills Building and in the Academy of Sciences. About 60 chemists and visitors were in attendance.

The president, Dr. R. C. Kedzie, of Michigan, presided over all of the sessions and delivered the presidential address at a joint session of the two associations the first evening of the convention. He considered the encouraging progress which the Association had made in testing and perfecting methods of agricultural analysis, and pointed out that the deliberations of the Association had become a subject of international interest. He called attention to some of the important advancements in methods and appliances for chemical analysis which have taken place in recent years, enabling far greater rapidity on the part of the official chemist without impairment of accuracy. He compared the problems for agricultural investigation in the East and in the West, and illustrated the difference in agricultural conditions and in the themes presented for study. In conclusion he urged continuing the study of methods of detecting food adulterations, and especially of identifying spurious dairy products and detecting adulterations of wheat flour with corn flour and other foreign substances.

Owing to the unusually short time which had elapsed since the last meeting of the Association, held the previous November, the reports of the referees on the different subjects included less analytical work than ordinarily. In some cases only two or three chemists were able to complete the examination of the samples sent them in time for reporting to the referee, and consequently very few recommendations were made for changes in the present methods.

The secretary of the Association, H. W. Wiley, read a paper entitled "Historical sketch of the Association of Official Agricultural Chemists." This was an interesting review of the origin and development of the Association, covering a period of nineteen years. It included an account of the meetings held previous to the organization of the present Association, and of the fifteen annual meetings of the latter. The reports of the earlier meetings were compiled from correspondence with persons who attended them. Following in this line, the referees on most of the subjects gave reviews of the progress of the Association in their respective subjects. As the reports of the earlier meetings are, some of them, very rare or entirely lacking, these summaries, giving a complete record of the progress of the Association, will prove of much interest and permanent value.

FERTILIZERS.

Potash.—The report on this subject, by B. B. Ross, gave a review of the work on methods of potash carried on by the Association since its organization, including the initial methods of the Association and the modifications and changes made from time to time. The report also gave the results obtained by 20 chemists on the samples distributed the past year, which were quite concordant. "The results bear strong testimony to the accuracy attained with the use of our present official method in the case of complex mixtures containing potash derived from a number of different sources."

The referee made no recommendations for changes, but suggested that the use of 1:1 sulphuric acid be allowed as an option for saturating mixed fertilizers preparatory to ignition.

The results obtained by the use of tared filters as compared with the Gooch crucible for collecting the platinum precipitate indicate that it is possible to secure quite satisfactory results with the former. The referee described a process which is being tested at the Alabama Station laboratory with a view to avoiding the second evaporation and ignition required by some fertilizers after treatment with sulphuric acid. "The residue in the dish is removed without addition of hydrochloric acid, rubbed with a pestle, and transferred to a beaker. It is next boiled with 300 cc. of water, as usual, and just before the conclusion of the boiling a small quantity of barium carbonate suspended in water is added and the boiling continued for a short time. The barium carbonate effects the precipitation of iron, alumina, some of the phosphates, and a part of the lime and magnesia. The solution, after cooling, is made up to 500 cc., an aliquot is filtered out, and a few drops of hydrochloric acid added and then an excess of platinum chlorid. The process is then continued as in the Lindo-Gladding method, using ammonium chlorid wash water." The results thus far obtained by this method are said to agree quite closely with those obtained by a solution in water by the regular Lindo-Gladding method.

It was voted to submit this method to further trial.

Phosphoric acid.—E. G. Runyan gave an interesting résumé of the work of the Association in testing methods for phosphoric acid, and traced especially the development of the volumetric method for more rapid work. Only a small number of results had been reported on the samples sent out, and these were not sufficiently complete to report upon.

B. W. Kilgore spoke of his investigations on precipitating phosphoric acid in the volumetric method by shaking, in continuation of his work the previous year. The precipitations were made at a laboratory temperature of about 20° C. or more, and no trials were made at a very low temperature. He reported the results as uniformly satisfactory, the precipitation being complete. A very large excess of molybdate solution could not be added without making the results too high.

M. A. Scovell gave the results of adding the phosphoric acid solution to the molybdate, instead of *vice versa*. This procedure was found satisfactory, the crystals not being so fine, the results concordant, and the molybdic acid not being precipitated. The solution filtered better and the precipitation was complete if sufficient molybdate of ammonia was added.

C. B. Williams presented some results obtained in making solutions for total phosphoric acid when aluminum phosphate was present, showing that the nitric and hydrochloric acids did not dissolve all of the phosphoric acid; and this was followed by a discussion of solvents to be used in case of different kinds of phosphates, the opinion being that individual judgment must be exercised largely.

Nitrogen.—The report on this subject, submitted by F. S. Shiver, in addition to the review of the progress in studies of methods for nitrogen determination, gave the results of a further study of the permanganate methods for determining the availability of organic nitrogen. With the alkaline-permanganate method (Jones) "it appears that many of the analysts experienced difficulty in securing concordant results." The referee considered the results very unsatisfactory in some cases, as, for instance, with cotton-seed meal and ground fish, the relative availability of the nitrogen as shown by this method being too low. With the neutral permanganate method (Street) the results were "quite satisfactory on the whole. . . . Practically everyone seemed to secure good duplicates." The method is considered very promising, " not only because of the uniformity of the results obtained by its use, but also because of the agreement of these results with those of vegetation tests." A finer grinding of the substance than that prescribed by the Association (to pass a sieve with holes 1 mm. in diameter) was found to slightly increase the amount of available nitrogen, and it was suggested that in future a sieve with 50 meshes to the inch be used.

The referee recommended that the neutral permanganate of potash method (Street) be subjected to trial another year.

SOILS AND ASH.

The referee on this subject, B. L. Hartwell, stated that so little work had been done during the past year it was determined to postpone reporting it until another year. He gave a review of the history of soil investigation, compiling the results obtained by the Association and reviewing its work in determining the more active constituents of plant food. It was shown that the analytical results obtained with the use of strong solvents were not in accord with what would be expected from the history of the fertilizing and cropping of the soil. This was thought to be due in part at least to faulty sampling of the soil, and extreme care was urged in this respect. Referrence was made to the occurrence in many soils of phosphoric acid largely associated with humus, in which form it is quite readily available to plants but not dissolved by weak hydrochloric acid. The belief was expressed that "success in drawing right conclusions in regard to the value of a solvent must depend in a very large degree upon our correct knowledge of the productiveness of the soil and to our carefulness in obtaining representative samples."

A. Goss suggested that the differences in results with the use of weak acids were frequently due to the neutralizing action of lime and magnesia in the soil. Other speakers emphasized the necessity of great care in sampling soils, i. e., taking samples at a sufficient number of places in the field and thoroughly mixing them.

The question of dividing the subject of soils and ash, which heretofore has been assigned to one referee, was discussed and it was voted to have a separate referee for each in the future.

FOODS AND FEEDING STUFFS.

The report of the referee, Thorn Smith, reviewed the work of the Association on this subject and especially on the determination of carbohydrates, and urged that more work on the latter subject be done. The results for the last year were not received in time for reporting.

The associate referee, C. A. Brown, jr., sent a paper on the determination of starch, which was principally a review of the work of the Association.

A. Goss read an interesting paper on "The protein factor of 6.25 as applied to beef," based upon analytical studies of a side of beef. He showed that the factors for different cuts varied from 5.95 in the case of the navel to 6.24 in the case of the sirloin. "In a general way it would seem that for such cuts as the sirloin, sirloin steak, and round steak, in which the greater part of the sample is pure muscular tissue, the 6.25 factor is more nearly correct than in the case of such cuts as the navel, lower thin flank, and leg, in which tendon and connective tissue is present in comparatively larger quantity." He suggested the factor 6.14 as the average for the whole side.

C. D. Woods called attention to the loss of nitrogen in drying meat, and believed that the protein factor must be obtained by separating the different kinds of tissue.

Food standards.—The report of the committee on food standards, presented by W. Frear, reviewed the work which has been done at the request of the committee by chemists throughout the country with a view to securing data to serve as a basis for standards. This work has been divided by topics among different chemists, and is progressing so well that it is the belief of the committee that it will soon be possible to formulate a system of standards such as the food bills now in Congress call upon the Association to provide. The committee asked authority to publish the system of standards as soon as it was possible to do so, and this was granted and the committee continued.

FUNGICIDES AND INSECTICIDES.

The report on fungicides and insecticides, sent by L. A. Voorhees, associate referee, was of special interest, as it was the first report on this subject which has been presented before the Association. It traced the growth of the study of fungus diseases and insect enemies of crops, and the increasing practice of spraying, which has resulted in a large demand for insecticide and fungicide materials. Certain of these, as copper carbonate, potassium cyanid, potash lye, formalin, tobacco preparations, Paris green, London purple, and other arsenicals, are either subject to adulteration or substitution, or vary widely in composition as the result of the method of preparation and the degree of purity. "It would seem that analytical work on insecticides and fungicides is much needed, and at present should include the following determinations: Copper, cyanogen, alkalis, formalin, nicotin, and arsenic." No analytical work was reported, but provisional methods were proposed which were adopted as such by the Association.

B. W. Kilgore suggested that "the best work which this Association could do would be to determine the definite form of the compounds in the arsenical insecticides," since the injuries from the use of such materials are frequently traceable to free arsenic, the effect of which may be neutralized by adding lime.

R. E. Blouin, of Louisiana, gave an account of the Paris green inspection in that State, which is provided for by law, and of the methods of analysis employed.

G. W. Shaw stated that he had found the potassium chlorate method most satisfactory for arsenic; and R. C. Kedzie spoke of the arsenid of lime which was coming into use and the practical method of its preparation.

DAIRY PRODUCTS.

The report of the referee, J. B. Weems, reviewed the work of the Association relating to this subject, and presented returns received from 7 chemists on the determination of the proteids of skim milk which had been preserved with formalin. No recommendations were made, but the suggestion was offered that the investigation of methods for this particular branch of the subject be continued another year.

No reports were presented by the referees on liquors and food adulteration, sugar, and tannin.

MISCELLANEOUS.

B. W. Kilgore presented a brief report for the committee on volumetric standards. This related principally to the question of temperature of laboratories and showed that 20 to 22° C. was more nearly the working temperature of southern laboratories than 15° C. H. W. Wiley referred to the discussion of this subject before the International Congress of Chemists at Vienna, at which the suggestion was made that different standard temperatures be adopted by different countries to suit their conditions. It was thought that 17.5° C. would be better adapted for Germany. The congress at Vienna voted unanimously to adopt the absolute standard of measure and to discontinue the use of the so-called Mohr liter as soon as possible.

The committee on rewriting the methods of the Association reported and presented a revised edition of Bulletin 46 of the Division of Chemistry of this Department as the result of its work.

The report of the committee on abstracting was presented by E. W. Allen. This report showed that the abstracting of literature relating to analytical methods had been continued by the members of the committee as in former years, the abstracts being published in current numbers of the Experiment Station Record.

The thanks of the Association were expressed to the various committees who were instrumental in entertaining the Association during its meeting, and especially to M. E. Jaffa, chairman of the local committee of arrangements, and to the retiring president, R. C. Kedzie.

OFFICERS OF THE ASSOCIATION.

The officers elected for the ensuing year are as follows: President' B. W. Kilgore; vice-president, L. L. Van Slyke; secretary, H. W. Wiley; additional members to the executive committee, M. E. Jaffa and A. Goss.

Following the suggestion offered in the Association, the incoming president continued the referees for another year as far as this could be done, in order that they might have further opportunity than had been afforded by the short period since the last meeting. The referees and committees as announced are as follows:

Phosphoric acid: Referee, E. G. Runyan, Washington, D. C.; associate referee, H. K. Miller, Lake City, Fla.

Nitrogen: Referee, F. S. Shiver, Clemson College, S. C.; associate referee, W. R. Perkins, Agricultural College, Miss.

Potash: Referee, B. B. Ross, Auburn, Ala.; associate referee, L. S. Munson, Washington, D. C.

Soils: Referee, B. L. Hartwell, Kingston, R. I.; associate referee, M. E. Jaffa, Berkeley, Cal.

Ash: Referee, A. E. Shuttleworth, Guelph, Canada; associate referee, G. S. Fraps, Raleigh, N. C.

Dairy products: Referee, J. B. Weems, Ames, Iowa; associate referee, F. W. Woll, Madison, Wis.

Foods and feeding stuffs: Referee, Thorn Smith, Moscow, Idaho; associate referee, C. A. Brown, jr., State College, Pa.

Liquors and food adulteration: Referee, H. A. Weber, Columbus, Ohio; associate referee, W. D. Bigelow, Washington, D. C.

Sugar: Referee, E. Fulmer, Pullman, Wash.; associate referee, G. L. Spencer, Washington, D. C.

Tannin: Referee, O. Carr, Corry, Pa.; associate referee, E. J. Haley, Ridgway, Pa.

Fungicides and insecticides: Referee, E. A. de Schweinitz, Washington, D. C.; associate referee, L. A. Voorhees, New Brunswick, N. J.

Abstract committee: E. W. Allen, Washington, D. C.; J. T. Anderson, Auburn, Ala.; W. H. Beal, Washington, D. C.; R. E. Blouin, New Orleans, La.; W. F. Hand, Agricultural College, Miss.; G. W. Shaw, Corvallis, Oreg.; J. P. Street, New Brunswick, N. J.; H. Snyder, St. Anthony Park, Minn.; C. B. Williams, Raleigh, N. C.

Committee on food standards: H. W. Wiley, Washington, D. C.; H. A. Weber, Columbus, Ohio; M. A. Scovell, Lexington, Ky.; E. H. Jenkins, New Haven, Conn.; W. Frear, State College, Pa.

Committee on fertilizer legislation: H. W. Wiley, Washington, D. C.; B. W. Kilgore, Raleigh, N. C.; H. B. McDonnell, College Park, Md.; H. A. Huston, Lafayette, Ind.; B. B. Ross, Auburn, Ala.

Committee on volumetric standards: B. W. Kilgore, Raleigh, N. C.; C. L. Penny, Newark, Del.; E. E. Ewell, Washington, D. C.; G. C. Caldwell, Ithaca, N. Y.; H. W. Wiley, Washington, D. C.

RECENT WORK IN AGRICULTURAL SCIENCE.

CHEMISTRY.

An examination of commercial flour, H. KRAEMER (*Jour. Amer. Chem. Soc., 21 (1899), No. 8, pp. 650–663, figs. 2*).—Directions for the qualitative and quantitative examinations of flour with especial reference to adulteration with corn meal are given. The reagents for the qualitative examinations are enumerated, together with their effects upon the flour. The same reagents are used in the quantitative examination of the flour, the method proposed depending upon the inspection of a sample of known weight with the microscope. The author's principal deductions follow:

> "[Commercial flours may be divided into] (1) those that produce a stiff and cohesive dough in the proportion of 11 to 15 gm. of flour to 10 cc. of water; as, for example, a good spring wheat flour; (2) those that do not produce a stiff and cohesive dough in the proportion of 11 to 15 gm. of flour to 10 cc. of water.
>
> "These may be further divided into the following subclasses: (A) Those that form a smooth, jelly-like paste upon boiling 1 gm. of flour with 15 cc. of water for about 1 minute; as, good winter wheat and some of the blended flours. (B) Those in which a more or less granular or liquid paste results.
>
> "This subclass may be further subdivided into (a) those which give off an odor of roasting corn when heated in glycerin to boiling for a few minutes, as samples containing corn meal. (b) Those that do not give off an odor of roasted corn when heated to boiling with glycerin, as lower grades of flour.
>
> "The quality of these flours may be still further determined by a microscopic examination of either the flour or the gluten mass after removal of the starch, when the presence of fungi and other foreign substances are revealed.
>
> "It appears that in certain sections of the country the adulteration of flour, as of other powdered commercial products, is still practiced, yet it may be said that as a rule the article as found in the Eastern markets represents a higher grade of product than has formerly been reported."

Notes on milk analysis, L. DE KONINGH (*Analyst, 24 (1899), June, pp. 142–146*).—Sour milk is prepared for analysis by the addition of a definite volume of ammonia or caustic alkali, preferably sodium hydrate solution of 1.030 sp. gr., after which fairly accurate hydrometer readings (using given corrections) and centrifugal fat tests can be carried out.

The presence of cane sugar in milk is detected by a blue coloration upon heating 10 cc. of the sample with 2 cc. of saturated solution of ammonium molybdate and 8 cc. of hydrochloric acid (1 to 8) in a water bath for 5 minutes at 80° C.

In testing for boric acid 100 cc. of milk is heated to boiling in a covered beaker, 8 cc. of nitric acid (1 to 50) added and then cooled and filtered. The filtrate is evaporated to dryness with ½ gm. of sodium carbonate, and burned to a gray ash, the soluble portion of which should be examined as usual.—E. B. HOLLAND.

Note on boric acid in milk samples, E. G. CLAYTON (*Analyst, 24 (1899), June, pp. 141–143*).—A report on the examination of 403 samples for boric acid by testing the acidulated ash with tumeric paper, confirming the same with alkali. In the discussion following it was stated that the reaction is very readily obtained by heating ½ cc. of milk directly with a slightly acidulated tincture of tumeric.—E. B. HOLLAND.

Oxidation of the ammonia produced by the ferments of the soil, E. DEMOUSSY (*Ann. Agron., 25 (1899), No. 5, pp. 232–244*).—Culture solutions containing monomethylamin, trimethylamin, anilin, pyridin, and quinolin were inoculated with soil bacteria and the formation and oxidation of ammonia was observed. The amins underwent an apparently constant cycle of transformations when submitted to the action of the micro-organisms of the soil. Carbon was eliminated in the form of carbon dioxid, the excess of hydrogen as water, and the organic base was converted into ammonia, which was tranformed first into nitrous acid and finally into nitric acid. This held true even for the simplest amins closely analogous to ammonia. In no case was direct transformation of amins into nitrous acid observed. The more complex amins yielded ammonia and underwent nitrification very slowly.

A wash apparatus for the determination of nitric nitrogen according to G. Kühn, O. FOERSTER (*Chem. Ztg., 23 (1899), No. 19, pp. 196, 197, figs. 2*).—A rather complex tube attachment to the distillation flask, by means of which all gases and vapors must pass through water before reaching the condenser, thereby preventing the ammonia from carrying over with it into the condenser any alkali from the flask. At the same time, the wash liquid and accumulations from condensed steam are allowed to flow back into the flask, after they have reached a certain level.—J. T. ANDERSON.

A practical shelf for desiccators, H. BOMBERGER (*Chem. Ztg., 23 (1899), No. 23, p. 359, fig. 1*).—The shelf is made of porcelain, with circular, open-bottom, cup-like depressions of different sizes, to receive beakers, watch crystals, etc., as well as crucibles. A water bath also is described, on which this shelf takes the place of the usual copper rings. Substances to be dried, in suitable containing vessels, are placed on this shelf on the water bath, and when the drying is complete the shelf with its contents is transferred bodily to the desiccator for cooling.—J. T. ANDERSON.

Outline of industrial chemistry—a text-book for students, F. H. THORP (*New York: The Macmillan Co., 1898, pp. XX + 541*).

A text-book of physiological and pathological chemistry, G. VON BUNGE (*Lehrbuch der physiologischen und pathologischen Chemie. Leipsic: F. C. W. Vogel, 1899, 4. ed., pp. IV + 510*).

Report of the chemist, R. H. FORBES (*Arizona Sta. Rpt. 1898, pp. 170-181, fig. 1*).—In this report a brief account is given of the work of the chemical department of the station during the year ending June 30, 1898, in the following lines: Investigations of soils, especially of the Salt River Valley (see also Bulletin 28 of the station, E. S. R., 10, p. 420); experiments with cañaigre (see p. 240) and chemical studies of cañaigre extract; and analyses of sugar beets, sugar cane, water, milk, and fertilizers.

The use of compressed oxygen in elementary organic analysis and of soda-lime in the quantitative determination of carbon dioxid, F. G. BENEDICT and O. F. TOWER (*Jour. Amer. Chem. Soc., 21 (1899), No. 5, pp. 389-398*).

The determination of oxygen in water, L. MUTSCHLER (*Ztschr. Untersuch. Nahr. u. Genussmtl., 2 (1899), No. 6, pp. 481-484, fig. 1*).—A modification of Mohr's method is described, in which the reagents are introduced into the flask of water to be tested in sealed tubes which are broken, after the flask is closed, without access of air.

Determination of calcium and magnesium in ashes, J. K. HAYWOOD (*Jour. Amer. Chem. Soc., 21 (1899), No. 6, pp. 508-511*).—An abridgment of the method adopted by the Association of Official Agricultural Chemists in which washing of the iron and phosphoric acid precipitate is avoided.—L. H. MERRILL.

The determination of phosphorus in organic substances, E. LECOCQ (*L'Ing. Agr., 9 (1899), No. 10, pp. 611-617*).—A brief review of the various methods which have been proposed for this purpose.

The volumetric determination of iron in a hydrochloric acid solution, H. PELLET (*Bul. Assoc. Chim. Sucr. et Distill., 16 (1899), No. 10, pp. 980-982*).

A method for the exact determination of ash in the molasses of sugar factories and refineries, V. ZAMARON (*Bul. Assoc. Chim. Sucr. et Distill., 16 (1899), No. 10, pp. 967, 968*).

On the determination of invert sugar, G. BRUHNS (*Ztschr. Ver. Rübenz. Ind., 1899, No. 519, pp. 370-376*).

A new test for formaldehyde, N. LEONARD and H. M. SMITH (*Analyst, 24 (1899), April, p. 86*).—Milk "doctored" with formaldehyde when heated with an excess of hydrochloric acid containing a trace of some oxidizing agent, as ferric chlorid or bromin, takes on a violet color. The test is said to be sensitive to 1 part in 1,000,000.—E. B. HOLLAND.

Note on a possible source of error in modifications of the Leffmann-Beam method for estimation of fat in milk, H. D. RICHMOND and F. R. O'SHAUGHNESSY (*Analyst, 24 (1899), June, pp. 146-148*).—In the Gerber modifications of the Leffmann-Beam method, whereby the hydrochloric acid is eliminated, it was proved advisable to first add the sulphuric acid, then the milk, and finally the amyl alcohol, because if the sulphuric acid and amyl alcohol are left long in contact it has the tendency, especially in hot weather, to give high results.—E. B. HOLLAND.

The estimation of fat in milk, using petroleum ether as a solvent, H. D. RICHMOND and C. H. ROSIER (*Analyst, 24 (1899), July, pp. 172-175*).—The authors, working on a theoretical basis, evolved a process whereby the fat is separated as in the Gerber method, extracted from the acid liquid by petroleum ether, the ethereal solution washed several times with water and transferred to a tared flask. "This method compares well with others."—E. B. HOLLAND.

On the determination of added water in milk, A. G. WOODMAN (*Jour. Amer. Chem. Soc., 21 (1899), No. 6, pp. 503-508*).—The method rests upon the constant composition of milk serum. The milk is warmed with dilute acetic acid, cooled, filtered, and the specific gravity taken by means of a Westphal balance. Tables are given showing the specific gravity of the serum of pure milk and of milk of varying degrees of dilution.—L. H. MERRILL.

The estimation of pentosans and its application to the analysis of foods, O. HEHNER and W. P. SKERTCHLY (*Analyst, 24 (1899), July, pp. 178-183*).—The amount of pentosans, estimated by the phloro-glucin method, is used as an index of purity in certain foods.—E. B. HOLLAND.

Analysis of chicory, J. WOLFF (*Rev. Chim. Analyt. et Appl., 4 (1899), Nos. 5, pp. 157–162; 6, pp. 187–193*).—The methods followed by the author for the analysis of chicory are given and also the composition of typical samples.—H. SNYDER.

A glucosid of millet, E. F. LADD (*North Dakota Sta. Bul. 35, pp. 323–325*).—This was abstracted from a more extended account (E. S. R., 10, p. 794).

On the pectins, E. BOURQUELOT (*Compt. Rend. Acad. Sci. Paris, 128 (1899), No. 20, pp. 1241–1244*).

Solanin, P. CAZENEUVE and B. BRETEAU (*Bul. Soc. Chim. Paris, 21 (1899), No. 9, pp. 428–431; Jour. Pharm. et Chim., 6. ser., 9 (1899), No. 10, pp. 465–468*).

Analysis of wine ash, C. F. JURITZ (*Agr. Jour. Cape of Good Hope, 14 (1899), No. 7, pp. 461–463*).—Percentage of ash in 28 samples of wine and percentage of ash and of lime, potash, and phosphoric acid in ash of 11 samples.

A new indicator, E. RIEGLER (*Bul. Soc. Sci. Bucarest, 1898, No. 6; abs. in Bul. Soc. Chim. Paris, 21 (1899), No. 11, p. 559*).—The indicator is the nitrobenzene azoguiacol which alkalis color red and acids greenish yellow.

Upon the use of resorcin as an indicator, A. LEMOINE (*Bul. Assoc. Belge. Chim., 13 (1899), No. 4, pp. 177–189*).—The author states the various uses that may be made of resorcin as an indicator in volumetric work. The subject is discussed under the following heads: Analysis of water, analysis of commercial borax, determination of ammonia, of "fixed" fatty acids in butter, and acidimetry and alkalimetry.—H. SNYDER.

A new polarization apparatus with scale on the quartz wedge, G. BRUHNS (*Deut. Zuckerind., 24 (1899), No. 20, pp. 753–755, figs. 3*).

A new mercury pump, E. U. CHATELAIN (*Compt. Rend. Acad. Sci. Paris, 128 (1899), No. 18, pp. 1131, 1132, fig. 1*).

Sediment trap, A. H. COOTE (*Chem. News, 79 (1899), No. 2061, p. 241, fig. 1*).

A serviceable generator for hydrogen sulphid, W. P. BRADLEY (*Amer. Chem. Jour., 21 (1899), No. 4, pp. 370–376, fig. 1*).

Ether extraction apparatus for liquids in quantitative determinations, F. BAUM (*Chem. Ztg., 23 (1899), No. 23, pp. 249, 250, fig. 1*).—The essential parts are an extraction flask on a water bath for the ether, and an extraction cylinder for the liquid under examination, the two being suitably connected with each other and with the condenser by means of glass tubes. A tube leaves the extraction cylinder horizontally near the bottom, bends upward at right angles, and at a suitable elevation connects with the condenser. The ether vapor from the flask reaches the condenser, condenses, accumulates in this tube, and when it reaches a sufficient height it is forced by its own pressure through the liquid to be treated, and collects above the latter in the extraction cylinder. Thence it passes through an overflow tube back into the flask, there to be again vaporized and sent out on its course.—J. T. ANDERSON.

BOTANY.

Experiments with native and foreign fodder plants, D. MCALPINE (*Rpt. Australasian Assoc. Adv. Sci., 7 (1898), p. 945*).—A brief abstract is given in which it is stated that 120 varieties of grasses and fodder plants received from this Department were given a trial in Victoria, the object being to test their growth under different conditions of soil, climate, heat, and moisture, but mainly to prove their drought resisting properties. Twenty-one species of grasses from America resisted drought, and of these 7 were very conspicuous for their fresh green growth. Among fodder plants other than grasses two were found to be suitable to Australian conditions and very resistant to drought. These were hairy vetch and *Polygonum* sp.

A study of the root systems of wheat, oats, flax, corn, potatoes, and sugar beets, A. M. TEN EYCK (*North Dakota Sta. Bul. 36, pp. 333–346, figs. 7*).—The author has made a study of the roots of these plants, following the method given in the annual reports of the Wisconsin Station for 1892 and 1893 (E. S. R., 5, p. 480; 7, p. 568).

The studies on the corn roots were made at different stages, the first being when the plants were 30 days from planting. At this time the main roots appeared to have developed laterally and but few were found to have penetrated to a depth of 12 in., the bulk of the roots lying within 8 in. of the surface of the soil. The second lot examined were 55 days from planting, when the plants were 54 in. in height. In this lot the primary roots had penetrated to a depth of 2½ ft., the horizontal roots had increased and the length was much greater than in the former case, many extending from hill to hill. The lateral roots frequently sent up feeders within 2 in. of the surface. In the third sample of corn examined the specimens were taken 10 days after the corn had been killed by frost. At this time, although the leaves were brown and dry, the roots seemed to be still alive and growing. These roots had penetrated the ground to a depth of 3½ ft., and the soil of the entire field was fully occupied by them.

Wheat roots were examined 110 days after sowing the seed. Most of the main roots were found to extend directly downward, sending out numerous small feeders which practically occupied the soil to a depth of about 4 ft. Oats were examined with nearly the same results as were found in the case of the wheat.

The sugar beet roots were examined at maturity, or 133 days after planting the seed. With this plant the tap root extends almost perpendicularly downward into the ground, the lower part being quite small and thread like and reaching to a depth of more than 3 ft. The lateral roots started 4 or 5 in. from the surface, and there was but little root development in the upper 6 in. of the soil.

The flax roots were studied about the time the crop was ready to cut for seed. The roots were very small and easily broken, and the sample was not considered sufficiently good for photographing. The root system of the flax is quite unlike that of any other plant studied. It consists of a single, small, thread like tap root running vertically downward and giving off small short side roots in the first 12 to 18 in. The tap root reaches a depth of about 3 ft.; and, unlike the roots of the other plants, the flax roots do not form a network near the surface of the soil, nor do they occupy it so completely.

The investigations of potato roots were nearly a failure on account of the plants having been frosted. The roots of this plant are said to be few in number and do not run deep.

In general, it is said that crops may be divided into 2 classes, those planted in rows and cultivated, and those sown broadcast or drilled a few inches apart and not cultivated. In the first class are placed corn, potatoes, beets, etc., while in the latter are wheat, oats, and flax. The roots of the latter penetrate deepest into the soil, but make only short rudimentary lateral growth, while the roots of the cultivated crops spread out horizontally in every direction and occupy more soil, but do not extend so deep into the ground as those of the sowed crops.

Selective absorption of mineral elements by plants, E. DEMOUSSY (*Compt. Rend. Acad. Sci. Paris. 127 (1898), No. 23, pp. 970–973*).—The author reports a number of experiments with colza, buckwheat, rye, and rye grass on their ability to absorb, through their roots the salts of potassium, sodium, calcium, magnesium, etc. Young buckwheat plants grown in cultures containing equal quantities of nitrate and chlorate of potash absorbed in 5 days 6.5 mg. nitrate and only 2.7 mg. chlorate. Colza in 8 days, from a similar solution, absorbed 10.9 mg. nitrate and 4.6 mg. chlorate. Similar results were obtained with rye.

Experiments with potassium and calcium on rye, colza, peas, and lentils showed a considerable preponderance of potash absorbed. Colza takes up a little less calcium than soda, maize a little more. The comparison between potassium and sodium showed a slight absorption of sodium compared with that of potassium.

In general, when mineral solutions not poisonous to plants are presented singly, they are absorbed in about the same proportion as they exist in the normal plant. Injurious minerals are absorbed through the roots in very small quantities only. When grown in complex solutions, the plants exercise a selective power between the different materials in the solutions.

The author calls attention to the fact that these experiments were all made on young plants, and the results are not necessarily the same on older ones.

Dextrin as a reserve material in plants, LECLERC DU SABLON (*Compt. Rend. Acad. Sci. Paris, 128 (1899), No. 15, pp. 914, 915*).—The author states that most physiologists consider dextrin not as a reserve material but as a transitory product due to the action of diastase on starch. Investigations on a number of plants, however, seem to indicate that this view will have to be modified somewhat.

The author gives the starch and dextrin content in hyacinth bulbs for different periods of growth, from which it appears that the maximum dextrin content is found in the bulbs when in a resting stage. Other plants show similar characteristics. Tulip bulbs in a resting state contain 14 per cent of dextrin, and lily bulbs 18 per cent. In both these plants, as well as in hyacinths, the dextrin is always found in conjunction with starch. In the asphodel, where there is no starch, the dextrin amounts to 15 or 20 per cent, and sometimes even more. In this case there is no digestion of starch to form dextrin, and this latter substance must be considered as a reserve carbohydrate.

In conclusion, the author says that dextrin should be considered as playing 3 different rôles: (1) as a reserve in the organs during their formation, when it is used to form starch; (2) as a decomposition product of starch, and (3) as a reserve material independent of the starch during the resting period.

Formation and transformation of lecithin, J. STOKLASA (*Ztschr. Physiol. Chem., 1898, p. 398; abs. in Jour. Roy. Micros. Soc.* [*London*], *1899, No. 2, p. 181*).—The author states that in lupines kept in the dark the decomposition of albumin, formation of asparagin and glutamin, and the decomposition of lecithin take place not only in the leaves but also in the root tubercles. Lecithin is said always to be an accompaniment of the albuminoids, and is decomposed as a consequence of the darkening of the green leaves. The formation of lecithin and of the albuminoids depends on photosynthetic assimilation.

Inulin, H. FISCHER (*Beitr. Biol. Pflanz.* [*Cohn*], *8* (*1898*), *pp. 53–106; abs. in Jour. Roy. Micros. Soc.* [*London*], *1899, No. 3, pp. 291, 292*).—The author gives a detailed account of his investigation of the occurrence of inulin in plants, its properties, micro-chemical reactions, etc. This substance is said to be especially characteristic of the Compositæ, occurring in most of the tribes and in a large number of the genera of that order. It is also found in the allied orders Campanulaceæ, Lobeliaceæ, Goodeniaceæ, and occasionally elsewhere. It is said to occur very rarely in monocotyledons, and but one instance is reported of its occurrence in an annual plant. Its presence has been recorded in algæ, but has not been definitely determined in Gymnosperms, Pteridophyta, Bryophyta, or fungi. Its main function is undoubtedly that of a reserve food material in the dormant period of the plants, occurring especially in underground organs.

The author criticises the views of Nägeli, Meyer, and Bütschli respecting the nature of the swelling of this substance, and he claims that the mode of swelling by absorption of water is quite different from that of starch or gelatin. The sphæro crystals increase in volume, but do not pass gradually into a soluble condition, forming paste. On the contrary, they are said to dissolve completely like crystals or break up into numerous granules.

The making and improvement of wheats for Australian conditions, W. FARRER (*Rpt. Australasian Assoc. Adv. Sci., 7* (*1898*), *pp. 908, 909*).—A brief abstract is given of a paper read by the author before this association, giving an account of the origin of the work and principles on which it had been conducted. The qualities desired for improvement were increased rust resistance and increased gluten content. The methods adopted for improving the wheat plant were by selection and cross breeding combined with selection, the latter being considered the more advantageous. For Australian conditions the author states that the qualities of wheat especially demanded are ability to thrive in dry soils, stool sparingly, and ripen early. For rust resistance the author expresses the opinion that the solution of the problem has probably already been accomplished so far as the interior of Australia is concerned.

The bacteria of leguminous root tubercles, MAZÉ (*Ann. Inst. Pasteur, 13 (1899), No. 2, pp. 145–155*).—In previous papers (E. S. R., 9, p. 118; 10, p. 318) the author discussed the physiology and morphology of the bacteria which assist in the assimilation of free atmospheric nitrogen. In the present article the practical utilization of these organisms is discussed and the theories reviewed. The soil inoculation of Salfeld and the pure cultures of Nobbe are described, and the advantages of each pointed out. The author does not agree with Nobbe in that there is a separate race of bacteria for each species or group of nearly allied species of plants. He claims that such conclusions are not warranted either by field trials or a study of the physiology of the organisms themselves. He believes there are certain physiological forms of bacteria which are determined by the nature of the media in which they are developed. These are able to inoculate the roots of plants growing in soils offering the proper condition for their development. The same principle will probably apply to Alinit.

The author believes that the use of pure cultures of these organisms is not destined to play a very important part in agricultural practice.

On the distribution of bacteria through the soil, P. P. DEHÉRAIN (*Ann. Agron., 25 (1899), No. 6, pp. 289–293*).—Studies are reported in which the presence and activity of nitrogen-assimilating bacteria in soil which had been devoted exclusively to vine growing for 25 years were investigated. Pots were filled with soil from the vineyard, fertilized with superphosphate and stable manure, and from a plat where vetches had been grown the previous year. Comparisons were made between the crop of vetches grown in the different pots, from which it appears that the pots receiving manure gave the greatest yield, and those without fertilizer, but supposedly well inoculated with organisms for nitrogen assimilation, the least. Examinations of the roots showed an abundance of tubercles in every pot, although no leguminous crop had been grown on the vineyard soil for at least 25 years. .

The author believes there is an abundance of bacteria carried by the winds, etc., to all soils, and the addition of cultures such as Alinit and Nitragir are unnecessary. In order to obtain the best results, he says, it is better to provide the proper conditions for both the bacteria and the plants themselves.

His observations are said to substantiate those of Mazé in that there are apparently distinct classes of bacteria for calcareous soils and for sandy ones.

Nitragin experiments, E. F. LADD (*North Dakota Sta. Bul. 35, pp. 327–329*).—The author conducted a series of experiments to ascertain whether any advantage would be derived from inoculating North Dakota soils with germs obtained from cultures from the roots of peas. The material used was that known commercially as Nitragin. A series of pot experiments was conducted in sand and garden soils, and the results obtained indicate a marked advantage resulting from the inoculation of the soil in the case of the sand cultures, but with the garden soil already rich in organic matter the advantage was very slight.

In order to test the experiment more fully the same experiment was conducted in plats, with similar results.

The general conclusion reached from the experiment is that where the soil is well stocked with organic matter the gain obtained is not sufficient to warrant recommending the use of Nitragin. In the case of light sandy soils and for truck gardening it is possible that it might prove valuable.

Chemical analyses were made of the plants grown in the various experiments with the following results:

Chemical composition of peas grown with and without Nitragin.

	Moisture.	Protein.	Fat.	Crude fiber.	Nitrogen-free extract.	Ash.
PLAT EXPERIMENTS.						
Grown in sand:	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
With Nitragin	4.10	14.18	6.57	20.05	47.80	7.30
Without Nitragin	5.25	11.06	5.14	21.15	48.80	8.60
Grown in garden soil						
With Nitragin	6.60	20.12	6.87	20.20	36.31	6.60
Without Nitragin	4.15	20.56	6.75	21.60	37.64	4.15
FIELD EXPERIMENTS.						
With Nitragin	4.92	22.50	5.50	16.30	42.40	4.92
Without Nitragin	3.49	22.50	5.68	20.83	38.15	3.49

Elementary science bulletins, W. J. BEAL (*Proc. Mich. Hort. Soc., 1897, pp. 343-363, figs. 43*).—Notes are given on a number of seeds before and after sprouting and observations recorded on the behavior of leaves of clovers, etc., at different times of day.

Cereals and their relations to the life zones in North America, C. S. PLUMB (*Proc. Soc. Prom. Agr. Sci., 1898, pp. 137-140*).—Notes are given on investigations on the distribution of corn, wheat, and oats as influenced by the different life zones. The details of these have been published as Bulletin 11 of the Division of Biological Survey of this Department (E. S. R., 10, p. 723).

American grasses—II, F. LAMSON-SCRIBNER (*U. S. Dept. Agr., Division of Agrostology Bul. 17, pp. 349, figs. 325*).—This bulletin is in continuation of Bulletin 7 of the Division (E. S. R., 10, p. 327). Illustrated notes are given on 325 species of grasses, many of which are illustrated for the first time. The prominent characteristics, habitat, distribution, and time of flowering of each species are given.

The flat pea, F. LAMSON-SCRIBNER (*U. S. Dept. Agr., Division of Agrostology Circ. 11, pp. 6, figs. 3*).—Descriptive notes are given of the flat pea, which is a variety of *Lathyrus sylrestris*. The history of its introduction is stated, and the various uses to which these plants have been put are described. The methods of cultivation are given and chemical analyses are quoted from various station publications. The value of the flat pea as determined at a number of the stations is outlined, and in conclusion the author states that in the sandy arid regions of the West, especially in the limestone and chalky regions of the Southwest, the flat pea may be considered as having some value, but where other forage crops can be grown, such as corn, sorghums, rye, barley, clovers, or the ordinary tame grasses, it will not pay to cultivate this plant for fodder.

Grazing problems in the Southwest and how to meet them, J. G. SMITH (*U. S. Dept. Agr., Division of Agrostology Bul. 16, pp. 47, figs. 9*).—Notes are given on the free ranges and effects of overstocking. The investigations of the author of various problems of grazing are given at some length. Destruction of grasses by animal pests and the deterioration through the increase of weeds, the principal of which are prickly pear and mesquite, are discussed.

Various methods of renewing cattle ranges are briefly mentioned, and as additional aids to range improvements the author mentions stack silage, hay, and attention to the water for stock. The grazing regions of Texas and New Mexico are divided into a number of regions, each of which is bounded and its characteristics described.

Notes on Panicum colonum (*Queensland Agr. Jour., 4 (1899), No. 5, p. 364, pl. 1*).—This grass, which is highly esteemed, is figured and described. It is claimed to be valuable for pasturage and hay.

Notes on one of the so-called native millet grasses, J. H. MAIDEN (*Agr. Gaz. New South Wales, 10 (1899), No. 6, pp. 494, 495, pl. 1*).—Notes are given on a variety of *Panicum decompositum*. This grass is said to grow well and provide abundant fodder. Horses do not seem to like it, although sheep thrive on the grass and hay. This plant differs from the highly esteemed *P. decompositum* in having narrower leaves and permanently erect branches and panicles.

Some notes on the progress of variety study in timothy, A. D. HOPKINS (*Proc. Soc. Prom. Agr. Sci., 1898, pp. 120–122*).—Notes are given in which the author briefly describes 8 varieties of timothy which have resulted from selection. The important characters which are exhibited by the different varieties are readily retained, and the author thinks that larger yields and superior qualities of hay and seed may be obtained in this manner.

Ramie, or China grass (Bœhmeria nivea), W. SOUTTER (*Queensland Agr. Jour., 4 (1899), No. 5, pp. 380–382, pls. 2*).—Illustrated notes are given of this fiber plant, together with directions for its cultivation and utilization.

Plants of the rabbit-infested country of South Queensland, J. F. BAILEY (*Rpt. Australasian Assoc. Adv. Sci., 7 (1898), pp. 448–451, pls. 6*).—A list is given of a number of plants which are able to withstand the severity of the climate of the rabbit-infested regions along Bulloo River and which thrive when all other plants seem to be destroyed by drought.

Plants reputed poisonous to stock, F. M. BAILEY (*Queensland Agr. Jour., 4 (1899), No. 6, pp. 465–468, pls. 2*).—Notes are given on *Hibbertia bennetti* and *Nicotiana suaveolens*, *Acacia cunninghami*, *A. delibrata*, and *A. penninervis*. The acacias, or some of them, are regarded as valuable forage plants at certain stages of growth, and their poisonous qualities are said to be due to the presence of saponin in the unripe pods. *Trema aspera*, which has been considered poisonous, probably owes its injurious quality to its forming bezoars in the stomachs of cows and horses.

The supposed poisonous plants of western Australia, F. TURNER (*Rpt. Australasian Assoc. Adv. Sci., 7 (1898), pp. 910–919*).—The author popularly describes 13 species of indigenous and introduced plants which are suspected of poisoning or causing injury to cattle, horses, and sheep.

Notes on Yuccas (*Prometheus, 9 (1898), No. 165, pp. 775–778, figs. 3*).—Illustrated descriptive notes are given of *Yucca filamentosa*, *Y. aloifolia*, *Y. gloriosa*, *Y. filifera*, and *Y. brevifolia*, together with an account of the method of their fertilization, etc.

Distinctive characteristics of the sexes of Ginkgo biloba, L. HENRY (*Jour. Soc. Nat. Hort. France, 3. ser., 21 (1899), Feb.; Bul. Assoc. Anciens Élèves École Hort. Versailles, 1898, p. 592; cited in Gard. Chron., 3. ser., 25 (1899), No. 640, p. 201*).—It is claimed that female trees retain their leaves longer than male trees, at Paris a difference of 3 or 4 weeks being noticed. Early frosts may accelerate the fall, but appreciable differences can be noted in the two sexes.

Concerning the pollination of Cucurbita, A. BRIZI (*Bul. Soc. Bot. Ital., 1898, pp. 217–222; abs. in Bot. Centbl., Beihefte, 8 (1899), No. 6, pp. 435, 436*).

Investigations on the development of the seed coat and pericarp of the Gramineæ, P. GUÉRIN (*Ann. Sci. Nat. Bot., 8. ser., 9 (1899), No. 1, pp. 1–59, figs. 70; Bul. Soc. Bot. France, 45 (1898), No. 6–8, pp. 405–411*).

Investigations on the growth of plants, L. MONTEMARTINI (*Atti Inst. Bot. Univ. Pavia, 2. ser., 5 (1899), pp. 75–143*).—Investigations on the growth of a number of plants are reported, from which the author concludes that growth is not due to turgescence, but is a vital function of protoplasm. An extensive list of works consulted in the preparation of this paper is given.

Winter growth of buds, E. KÜSTER (*Beitr. Wiss. Bot., 2 (1898), p. 401; abs. in Bot. Centbl., Beihefte, 8 (1899), No. 6, p. 420*).—The buds of maple and pine are said to show a small amount of growth between November and February during an ordinary winter.

The leafing of trees, A. C. FORBES (*Gard. Chron., 3. ser., 25 (1899), Nos. 649, p. 353; 652, p. 406*).—Notes are given on the order of leafing of a number of forest trees and some of the phenomena by which they may be influenced.

Physiological investigations on the utilization of the reserve material in seeds during germination, C. POURIEWITSCH (*Mem. Soc. Nat. Kiew, 15 (1896–98), pp. 519–621*).

Notes on transpiration, H. H. DIXON (*Proc. Roy. Irish Acad., 3 (1898), pp. 618–635, figs. 2; abs. in Jour. Roy. Micros. Soc. [London], 1899, No. 3, pp. 300, 301*).—The author regards transpiration as a vital rather than a physical phenomenon. The elevation of the water of the transpiration current when the leaves are surrounded by a saturated atmosphere is said to be effected by a pumping action proceeding in the living cells of the leaves. This pumping action is said to be capable of raising water against all external hydrostatic pressure. In common with other vital actions, this is accelerated by a moderately high temperature and is dependent on the supply of oxygen. This activity is possessed by the cells adjoining the terminal portion of the water conduits and in plants provided with water glands the pumping action is not limited to the secreting tissues of these glands.

Assimilation of nitrates by plants, T. WÖLFER (*Rostock, 1898, pp. 61, pls. 7; abs. in Jour. Roy. Micros. Soc. [London], 1899, No. 3, p. 300*).—From a series of experiments on the absorption, distribution, and assimilation of nitrates by cultivated plants, the author concludes that plants grown in the dark store up nitrates very rapidly and more abundantly than those grown in the light. Plants grown either in the dark or light in an atmosphere containing a larger amount of carbon dioxid than normal contain no starch and only traces of glucose. Nitrates could be detected only in small quantities in the vascular bundles A larger quantity is found in the bundle sheaths, and the largest amounts occur in the cells of the cortex and parenchyma.

METEOROLOGY.

Monthly Weather Review (*U. S. Dept. Agr., Weather Bureau, Monthly Weather Review, 27 (1899), Nos. 1, pp. 1–40, figs. 4, charts 9; 2, pp. 41–87, pls. 6, charts 13; 3, pp. 89–138, charts 13*).—In addition to the usual reports on forecasts and warnings and on weather and crop conditions, and meteorological tables and charts, No. 1 contains special contributions on Recent titles of papers bearing on meteorology, by W. F. R. Phillips; Hints to observers of shooting stars, by W. Harkness; The northwest gales of the southern Blue Ridge and Piedmont region, by B. C. Hawkins; and Hydrology of the Lake Minnetonka watershed, by G. W. Cooley (see p. 223); and notes by the editor on meteorological records in Iowa, history of weather telegraphy, the Tugrin fog dis peller, the international date, sensible temperatures, origin of the word "blizzard," forests and snowfall, and recent earthquakes.

No. 2 contains special contributions on Snow temperatures, by E. B. Calvert and W. F. R. Phillips; Recent papers bearing on meteorology, by W. F. R. Phillips; and Wave of billow clouds, by A. J. Henry; and notes by the editor on the weight or mass of the atmosphere, the Weather Bureau in Alaska, solar halo, frequency of injurious phenomena, barographs on ships, why do birds migrate? ice jam in the Niagara River, international cloud names, forecasts on letter boxes, the depth of atmospheric cold waves, the benefits of severe winters, weather versus climate, experiments in protection from frost, the dust in the atmosphere, the blessing of cold weather, recent earthquakes, the Weather Bureau and the ice business, and history of weather predictions.

No. 3 contains special contributions on Experiments in weather prediction, by W. A. Eddy; Selenium and its use for the measurement of sunshine, by N. E. Dorsey; Snow rollers, by A. H. Thiessen; Recent papers bearing on meteorology, by W. F. R. Phillips; and Utilization of fog, by A. McL. Hawks; and notes by the editor on the Pacific Coast division of the Canadian meteorological service, mirobia and seiches, meteorological reports by cable from Iceland, the International Meteorological Committee, meteorology in Russia, the daily weather map for Mexico, the utility of the weather map, obscure points in meteorology, meteorology in Great Britain, breaking up of the ice at Pierre, South Dakota, liquid air as a source of power, dust whirls and fairy dances, monthly charts for the West Indies, vertical temperature gradients, utilization of fog, the blue color of the sky, abstracts of university theses, and storm centers in the Pacific.

The importance of meteorology for the farmer (*Fühling's Landw. Ztg., 18 (1899), No. 10, pp. 361-366*).

Meteorological observations, J. E. Ostrander and A. C. Monahan (*Massachusetts Hatch. Sta. Met. Buls. 124, 125, 126, pp. 4 each*).—Summaries of observations on pressure, temperature, humidity, precipitation, wind, sunshine, cloudiness, and casual phenomena during April, May, and June. The data are briefly discussed in general notes on the weather of each month.

Meteorological observations (*Compt. Rend. Ann. Sta. Agron. Ploty, 1896, pp. 99-124, figs. 2, charts 3*).—These include observations on rainfall, evaporation, soil moisture and temperature, pressure, temperature and humidity of the air, sunshine, cloudiness and solar radiation, wind, and miscellaneous phenomena. The observations are recorded in tables and charts.

The meteorology of 1898 (*Trans Highland and Agr. Soc. Scotland. 5. ser., 11 (1899), pp. 317-324*).—A table "gives a comparison of the winds, mean pressure, temperature, rainfall, cloud, and sunshine of 1898 as compared with the previous 42 years' averages" for all Scotland. The general features of the weather of each month of 1898 and the effect of the season on the growth of crops, especially wheat, barley, oats, potatoes, and turnips, are briefly discussed.

Cloud observations in Victoria, P. Baracchi (*Rpt. Australasian Assoc. Adv. Sci., 7 (1898), pp. 259-265, pls. 4*).—A report of progress in observations made in pursuance of the plan adopted by the International Meteorological Committee in 1894 on form, position, and direction of movement of clouds, with special notes on cirrus clouds and on direction and force of the surface wind, temperature of the air, weather characteristics, etc.

Weather predictions and weather reports of the fifteenth and sixteenth centuries, G. HELLMANN (*Wetterprognosen und Wetterberichte des XV und XVI Jahrhunderts, No 12, Neudrucke von Schriften und Karten über Meteorologie und Erdmagnetismus. Berlin: A. Asher & Co., 1899*).

Weather forecasting, W. L. MOORE (*U. S. Dept. Agr., Weather Bureau Bul. 25, pp. 16*).—"The article is written in popular style, and contains information as to the movements and progression of storms, the different kinds of storms, how forecasts are made, etc., and, in addition, a brief history of the early researches in meteorology and of the organization of the Weather Bureau." It is a reprint of an article which was published in *The Forum, May, 1898.*

Phenological observations in Klagenfurt, 1895–1898, H. SABIDUSSI (*Jahrb. Naturhist. Landes Mus., Kärnten, 25 (1899), pp. 49–60*).

The causes of the earlier or later appearance of the vegetation period in different years in the Scandinavian countries, O. PETTERSON (*K. Landt. Akad. Handl., 38 (1899), No. 1, pp. 3–13*). —The vegetation period is shown to stand in close relation to the surface temperature of the Atlantic Ocean during the winter months.

Hydrology of the Lake Minnetonka watershed, G. W. COOLEY (*U. S. Dept. Agr., Weather Bureau Doc. 194, pp. 10, figs. 4*).—A discussion of data (in tables and charts) on rainfall (1881–1889), evaporation, and run off, reprinted from *Monthly Weather Review, 27 (1899), No. 1.*

Monthly bulletin of the River and Flood Service, H. C. FRANKENFIELD (*U. S. Dept. Agr., Weather Bureau Doc. 182, pp. 16, chart 1*).—A summary of observations on river stages and the condition of navigation during October, 1898.

Measurement of precipitation, W. L. MOORE and C. F. MARVIN (*U. S. Dept. Agr., Weather Bureau Doc. 193, pp. 28, figs. 10*).—This is a pamphlet of instructions for the measurement and registration of precipitation by means of the standard instruments of the U. S. Weather Bureau.

Water in the Sahara, LAHACHE (*Rev. Sci. [Paris], 4. ser., 11 (1899), No. 21, pp. 651–654*).

WATER—SOILS.

Analyses of water for irrigation, G. L. HOLTER and J. FIELDS (*Oklahoma Sta. Bul. 38, pp. 3–7*).—Analyses of the solids of 44 samples of stream, well, and spring water are reported, including a number already published (E. S. R., 9, p. 696). A summary of the conclusions reached is as follows:

"(1) The water of the Salt Fork of the Arkansas and of the Cimarron River is unfit to be used for irrigation, except in very limited amounts.

"(2) The water of the North Canadian and of the South Canadian may be safely used for irrigation.

"(3) None of the smaller streams that have been examined, except the Black Bear, are unfit to be used for irrigation.

"(4) Well waters vary greatly in the amount and character of the dissolved mineral matter which they contain, and should be analyzed before being arranged to be used for irrigation.

"(5) A partial survey of the conditions which must be met in the construction of reservoirs for the retention of storm river waters has been made, and it is not clear that this method is entirely feasible in all cases."

The alkali soils of Montana, F. W. TRAPHAGEN (*Montana Sta. Bul. 18, pp. 21–50*).—The formation of soil; the origin, source, and rise of alkali; the treatment of alkali lands; the effects of alkali upon plants and soils, and the vegetation of alkali flats are discussed, and determinations of sulphuric acid, calculated as sodium sulphate, and of alkalinity in terms of sodium carbonate of 325 samples of alkali soils taken at different depths at about 50 localities in the State are reported. "Almost without exception where alkali exists in Montana, it is of the 'white' kind and not the 'black.' It owes its origin to the rock from which the soil was formed and is present because the annual precipitation is not sufficient to carry it away in solution."

Underdraining, where it will pay, judicious surface flooding, growing of alfalfa, and cautious irrigation are suggested as a means of amelioration. The use of gypsum on black alkali is recommended.

Soil studies, E. F. LADD (*North Dakota Sta. Bul. 35, pp. 310-322*).—These include chemical analyses of 9 samples of soil (2 from Mayville, 1 from Edgeley, and 6 from the station rotation plats), the grading of 6 samples with reference to gumbo properties, and studies of the humus and humates of 26 samples.

The water-soluble matter of the gumbo soils was determined, but the results apparently threw no light on the peculiar properties of these soils. The soil on which there had been the greatest crop rotation contained the largest amount of nitrogen and organic and volatile matter and the smallest amount of sand and silica. Almost the reverse was true of the soils showing the most marked gumbo properties.

Ordinary chemical analyses of the soil of adjacent fields, one of which had been cropped, mainly in wheat, for 17 years, and was beginning to show a decline in productiveness, and the other had remained in native sod, gave little "to indicate why there should be any marked difference in the productivity of the two soils." A study of the humus and humates gave the following results:

Humus and humates in old and new soils.

	Old soil.	New soil.
	Per cent.	*cent.*
Humates	3.04	4.27
Humus	1.56	2.53
In the humates:		
Phosphoric acid	.179	.192
Calcium oxid	.892	1.030
Potassium oxid	.075	.089
Nitrogen.	.041	.094

"Humus is that portion of the organic or vegetable matter in the soil that has reached a certain stage of decay, while humates refer to all the matter that is extracted with the humus[1] and is the mineral portion of the soil together with the humus. It will be seen that by processes of cropping the humus in the old soil has been reduced 39 per cent as compared with the adjoining new soil, and it is not probable that this represents the full extent of loss. Of nitrogen in the humus there has been a loss from the old field of 56 per cent. It has been assumed[2] that a soil for wheat growing should contain not less than 5 per cent of organic matter, and in this case we have only 1.56 per cent of humus and 5.26 per cent of volatile matter, not all of which was organic matter, and the amount of humus nitrogen is very low, 0.041 per cent, which is less than one fourth of the average humus nitrogen as determined for other soils. Is it not possible that we have here an answer to the question, What is the probable reason for loss of productive power in this soil? The remedy would seem to be to increase the humus matter in the soil by such a system of crop rotation as would best insure this end.

---

[1] By means of 4 per cent ammonia solution.

[2] North Dakota Sta. Bul. 32 (E. S. R., 10, p. 129).

"In the soil we have just been examining we find that along with the humus there is extracted considerable mineral matter. In case of the above soil 48 per cent of the total phosphoric acid in the soil was extracted with the humus, 42 per cent of the lime, and 31 per cent of the potash."

As the humus decreased the percentage of phosphoric acid, potash, nitrogen, and lime extracted with the humus decreased. Analyses of other soils show that an increase of humus in the soil is accompanied by an increase of mineral constituents associated with the humus, although the increase is not always uniform.

The 4 per cent ammonia extract of a soil was subjected to fractional precipitation by hydrochloric acid with the following results:

Composition of fractional precipitate of soil humus extract.

	One third	Two thirds.	Complete.
	Per cent	*Per cent.*	*Per cent.*
Humus	54.38	49.19	29.35
Ash	45.62	50.81	70.65
Nitrogen in precipitate.	6.67	3.67	1.33

"In washing the precipitate it was found quite soluble in water, and it can not be said that all of the ammonium chlorid formed was washed out, and there was also dissolved a small amount of the humates.

"The humates while still moist on the filter paper will be largely dissolved by continued washing with water, leaving not to exceed 20 per cent of residue on the paper. On ignition this residue is found to contain 68 per cent mineral matter and 32 per cent of humus. The residue is a black, shiny product resembling the broken surface of lignite coal. On boiling with water a portion of these humates are found to be soluble.

"On the other hand these humates, in the fresh condition, soluble in water, on drying and igniting, leave a mineral residue of 61 per cent, of which 86 per cent is not soluble in hydrochloric or nitric acid."

The humus, humates, and mineral matter contained in the humates were determined in 24 samples of soil. The following is a summary of the results:

Humus, humates, and mineral in humates of 24 samples of soil.

	Humates.	Humus.	Nitrogen.		Phosphoric acid.		Calcium oxid.		Potassium oxid.	
			Total.	In humus.	Total.	In humus.	Total.	In humus.	Total.	In humus
	Per ct.	*Per ct.*	*Per ct.*	*Per ct*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
Minimum	3.84	1.56	0.180	0.041	Trace	Trace.	Trace.	0	0.18	0.075
Maximum	15.26	7.90	.456	.362	0.40	0.199	2.70	1.03	.73	.233
Average	9.15	4.77	.292	.163	.269	.138	.944	.436	.409	.153

On the average the humates contained 56 per cent of the nitrogen of the soil, 51 per cent of the phosphoric acid, 37 per cent of the potash, and 46 per cent of the lime, while the humus constituted 52 per cent of the total humates extracted.

The soil of the Red River Valley wheat lands, A. M. TEN EYCK (*North Dakota Sta. Bul. 36, pp. 346-358, figs. 2*).—The soil of the station farm is fairly typical of these lands. It is described as "a very fertile, deep, black loam, underlaid by a subsoil slightly finer in texture and lighter in color, often called a clay, but which is more properly a compact, heavy loam."

Samples of the soil, taken at depths of 1 to 6, 6 to 12, 12 to 24, 24 to 36, and 36 to 48 in., were subjected to mechanical analysis. The method of analysis recommended by the Division of Soils of this Department (E. S. R., 8, p. 481) was followed with this exception: "Previous to the separation, instead of rubbing up the moistened sample in a mortar, or revolving it in a shaker for several hours, each 30 gm. was treated with 100 cc. of distilled water, stirred occasionally, and allowed to stand for 36 hours." The water capacity, weight per cubic foot, and water-soluble salts were also determined. "The water-soluble salts were determined from the filtrate obtained by placing 10 gm. of soil in 100 cc. of distilled water for 24 hours and then boiling the whole briskly for 10 minutes."

"The soil of the station farm is sticky and heavy to handle when at all wet, and below the depths to which it is annually loosened by the plow it is generally compact and often gummy. Spots of real gumbo are frequently met with." Analysis showed, however, that the soil contains a large percentage of pure sand (about 61 per cent) and that the second 6 in., the gummy portion, is the coarsest in structure of any of the samples analyzed. The weight per cubic foot varied from 56.12 lbs. in the surface foot to 99.44 lbs. in the fourth foot.

Reclamation of bog land in Ayrshire, J. CLARK (*Trans. Highland and Agr. Soc. Scotland, 5. ser., 11 (1899), pp. 150-161*).—An account is given of the methods pursued and the results obtained on two bogs, reclaimed with a view to their use in the growth of timothy hay. "The land [in the first case] was of a benty nature, mixed with heather and draw moss growing on black peat moss, varying in depth from 18 in. to 5 ft., with a cold, blue clay subsoil." Reclamation of this bog was commenced in 1893. The first important operation was the draining which the author describes as follows:

> "I first laid off the main drain, which I almost invariably made in the natural water course. The ordinary field drains were laid off 18 ft. apart at right angles to the main wherever this was practical. The main drain was made 3 in. deeper than the ordinary drains, to give a fall to the water from the latter.
>
> "As moss drains are distinctly different from clay ones I cut the main to the very far side of the field from its outlet and allowed it to remain open. I next cut the farthest away ordinary drain—that is, the one at the top of the main—and always tiled the drains from the top downward. This prevented any sludge from getting into the tile and obviated any fear of choking. The depth of the drains was regulated according to the depth of the moss. In this instance they vary from 2 ft. 3 in.

to 3 ft. 6 in. I do not like them far into the clay—not more than 6 in.—as the greatest volume of water is usually found between the moss and clay. But where the moss was found to be over 3 ft. 6 in. in depth—which was the rule in this instance—I placed a beech wood sole under the tile to prevent it from sinking."

The soil was given a heavy dressing (60 cartloads per acre) of ashes and roadside parings and 5 tons of gas lime per acre. It was plowed in 1894 and seeded to oats, with a top-dressing of 4 cwt. of dissolved bone per acre. The crop was light, but the succeeding crop of turnips, fertilized with 20 cartloads of barnyard manure, 3 cwt. of superphosphate, and ¾ cwt. of ammonium sulphate per acre, was good. Following the turnips, oats were again grown, with 5 cwt. of dissolved bone, with good results. The land was then seeded to grain and top-dressed in the fall with 10 tons of barnyard manure per acre. In the spring 1 cwt. of nitrate of soda was applied as a top-dressing. A fair crop of hay was obtained. With the above rotation the first cost of reclamation was repaid.

The second bog was deeper than the first but similar in other respects. The method pursued was much the same as in the first experiment. The tiles were laid 3½ ft. deep, but "it is now becoming very evident that this depth is not sufficient for land so soft and spongy as this was. The land has since become a great deal more consolidated, resulting in some places in a general subsidence of about 18 in., and even more in some of the softest parts. This is gradually bringing the pipes very near to the surface and at some time in the near future they will require to be deepened if the land is to be kept under cultivation."

The rotation has been oats, potatoes, and mixed grasses containing timothy with which manures and fertilizers were freely used, since, in the author's opinion, the liberal use of manures and fertilizers is essential to success in reclaiming such soil. The results while not so good as in the first experiment are considered very satisfactory.

On the dissemination of ferments in the soil, P. P. DEHÉRAIN (*Ann. Agron., 25 (1899), No. 6, pp. 289–293*).—Vetch was grown in pots of 50 kg. capacity on vineyard soil which had borne no leguminous plants for 24 years and on soil which had been cultivated in vetch the previous year. In each case one pot received no fertilizer and one 3 gm. of superphosphate. In addition one pot containing soil on which vetch had not previously been grown received 400 gm. of manure.

The results show that the soil which had not previously borne vetch gave the larger yield. Superphosphate did not increase the yield to any very great extent, but the beneficial effect of the manure was very marked.

Mazé has suggested that the tubercle bacteria of leguminous plants are of two classes, those which act in calcareous soils and those which act in siliceous soils. The soils at Grignon are calcareous, and the results reported above indicate that the organisms active in such soils are very generally disseminated there. This indicates the futility of applying Nitragin and Alinit. Instead of adding more organisms it would be better to make the conditions more favorable to those already present. One of the means of accomplishing this, suggested by the above experiments, is to increase the humus content of the soil by the addition of manure.

On the utilization by plants of the fertilizing constituents of soils containing different amounts of sand, E. Grosz (*Fühling's Landw. Ztg., 18 (1899), No. 8, pp. 291–297*).—Pot experiments were made with barley grown in (1) soil containing 0.155 per cent of nitrogen, 0.14 per cent of potash, 0.07 per cent of phosphoric acid, and 0.43 per cent of lime, and (2) the same soil mixed with ¼, ½, and ¾ its weight of sand. Data for yields and composition (fertilizing constituents) of the crop from the different pots are reported. These show that the fertilizing constituents were more completely utilized in the soils containing the larger proportion of sand than in those containing less sand but a larger amount of plant food.

The use of coloring matters in tracing the movement of waters in the soil, A. Trillat (*Bul. Assoc. Chim. Sucr. et Distill., 16 (1899), No. 10, pp. 956–968*).

The phosphoric acid content of arable soil, Maizières (*L'Engrais, 14 (1899), No. 27, pp. 636, 637*).—A discussion of the work of Pagnoul, Dehérain, and others bearing on the limits of the profitable use of phosphates.

Examination of soils (*Compt. Rend. Ann. Sta. Agron. Ploty, 1896, pp. 89–96*).—Mechanical and chemical analyses of the soil at different depths of the experimental fields of the station are reported.

Note on the correspondence between the results of the chemical analysis of a soil and its productiveness, A. N. Pearson (*Rpt. Australasian Assoc. Adv. Sci., 7 (1898), pp. 947–952, fig. 1*).—This correspondence is worked out for four unmanured plats on which sugar beets were grown. Making certain arbitrary allowances for (1) a deficiency of phosphoric acid, (2) nitrogen, (3) the favorable mechanical effect of lime in the soil, and (4) the injurious effect of an excess of soluble salts, a curve "representing the total effect of the constituents disclosed by the analysis" is obtained which agrees closely with the curve representing the actual productiveness.

Humates and soil fertility, E. F. Ladd (*Jour. Amer. Chem. Soc., 20 (1898), No. 11, pp. 861–867*).—A more complete account of this work is noted above under the title of soil studies (see p. 224).

Soil moisture and temperature (*Compt. Rend. Ann. Sta. Agron. Ploty, 1896, pp. 102–110*).—Observations at different depths are recorded.

Soil temperatures at Riga, G. Schweder (*Die Bodentemperatur bei Riga. Riga, 1899, pp. 24*).

FERTILIZERS.

The home mixing of fertilizers, C. E. Thorne (*Ohio Sta. Bul. 100, pp. 123–160, figs. 2*).—This is a republication in large part of an earlier bulletin on the same subject (E. S. R., 10, p. 532) to which is added the results of a continuation on corn and wheat of the comparative tests of home-mixed and factory-mixed fertilizers, partially reported in the earlier bulletin, and the conclusions of other experiment stations and investigators who have studied the subject of home mixing.

In experiments in 1898 "the various factory brands of fertilizers produced practically the same increase of corn as their duplicate home mixtures . . . but the wheat gave, not simply an equal, but a better return for the home mixture than for the factory brand."

The fertilizer control for 1898, A. W. BLAIR (*North Carolina Sta. Bul. 158, pp. 79–92*).—The bulletin gives a list of the publications of the North Carolina department of agriculture containing fertilizer analyses for 1898; notes on valuation; explanation of terms; and tabulated matter, including a list of firms registering brands for sale in the State during 1898, the number of brands licensed in the State each year during the last 14 years, the brands credited to the several States, comparisons of the fertilizer trade in 9 States, average composition of three classes of fertilizers, and number of brands of each below guarantee during 1897 and 1898.

"The number of brands registered for sale in North Carolina during 1898 exceeded by 150 the registration for 1897, which was the highest up to that time, and also shows a greater increase than in any previous year. This rapid increase has been noticeable since 1890, when there was a change from the brand tax to the tonnage tax.

"The consumption of commercial fertilizers has increased very rapidly each year, amounting to about 246,000 tons in 1898, valued at nearly $6,000,000, as against 208,000 tons during 1897, valued at about $5,000,000.

"The larger part of the fertilizers now used in the State are manufactured in North Carolina and Virginia.

"The average percentage composition of commercial fertilizers for 1898 is slightly above that for 1897, with the exception of available phosphoric acid in complete fertilizers, and this falling off is probably due to an interpretation of the law which allows a fertilizer high in ammonia and potash to fall below 8 per cent in available phosphoric acid.

"One out of every four and one-fifth of the whole number of fertilizers analyzed fell below its guarantee in some ingredient, and one out of eighteen and one-half in valuation."

Value of sheep manure, W. A. HENRY (*Breeders' Gaz., 35 (1899), No. 8, pp. 210, 211*).

Modern views concerning the changes in and treatment of barnyard manure, J. SEBELIEN (*Norsk Landmandsblad, 18 (1899), Nos. 10, pp. 116–119; 11, pp. 129–133*).

Methods of applying manure, C. F. CURTISS (*Breeders' Gaz., 35 (1899), No. 2, p. 36*).

Investigations on the use of 1 per cent sulphuric acid to check the fermentation of urine, A. M. LEONI (*Staz. Sper. Agr. Ital., 31 (1898), No. 3, pp. 209–221*).

Analysis of seaweed, F. B. GUTHRIE (*Agr. Gaz. New South Wales, 10 (1899), No. 6, p. 528*).—The fertilizing constituents in a sample of *Phyllospora comosa* are reported.

On the fertilizing constituents of apples and pears, E. HOTTER (*Jahrb. Pom. Landes Vers. u. Samen Control Sta., Graz, 5 (1897), pp. 22–24*).—The average percentages of various ash constituents are reported.

Analyses of commercial fertilizers, H. B. MCDONNELL ET AL. (*Maryland Agr. Col. Quart., 1899, No. 3, pp. 51*).—Tabulated analyses and valuations of 388 samples of fertilizers examined during the period from August, 1898, to January, 1899, inclusive, and a list of fertilizers licensed for sale up to February 1, 1899, accompanied by explanatory notes on valuation, etc.

Analyses of commercial fertilizers, B. W. KILGORE (*Mississippi Sta. Bul. 57, pp. 7*).—Analyses and valuations of 37 fertilizers are reported.

Analyses of commercial fertilizers, B. W. KILGORE (*Mississippi Sta. Bul. 55, pp. 22*).—This bulletin reports analyses and valuations (with guaranties) of 96 samples of fertilizers and gives a list of brands of fertilizers registered for sale, accompanied by explanations of terms and notes on valuation.

Phosphatic fertilizers, MAIZIÈRES (*L'Engrais, 14 (1899), No. 24, pp. 564, 565*).—A general discussion of this subject.

Notes and analyses of some New South Wales phosphatic minerals and phosphatic deposits, J. C. H. MINGAYE (*Rpt. Australasian Assoc. Adv. Sci., 7 (1898), pp. 332, 333*).—Analyses of pyromorphite, apatite, marsupial excrement, phosphatic deposits from caves, and coarse and fine gem sand from gold fields (largely small zircons).

On the occurrence of phosphatic deposits in the Jenolan caves, New South Wales, J. C. H. MINGAYE (*Rpt. Australasian Assoc. Adv. Sci., 7 (1898), pp. 327–331*).—In the samples analyzed the phosphoric acid varied from about 10 to 40 per cent. The deposits are probably limited.

Artificial slag, MAIZIÈRES (*L'Engrais, 14 (1899), No. 12, pp. 276–278*).—Discusses the Wiborgh phosphate (E. S. R., 10, p. 32).

The future of the potash industry, MAIZIÈRES (*L'Engrais, 14 (1899), No. 9, pp. 204, 205*).

The use of fertilizers in the spring, MAIZIÈRES (*L'Engrais, 14 (1899), No. 13, pp. 299–301*).

Lime and its uses in agriculture, A. P. AITKEN (*Trans. Highland and Agr. Soc. Scotland, 5. ser., 11 (1899), pp. 220–245*).—This treats in a popular way of the sources, properties, and agricultural uses of lime and of its chemical, physical, and biological effects in the soil.

A summary of fertilizer experiments (*L'Engrais, 14 (1899), Nos. 21, pp. 495–498; 23, pp. 512–540; 25, pp. 591–594, figs. 3*).

A test of plaster on ordinary clover, A. DAMSEAUX (*L'Engrais, 14 (1899), No. 13, p. 302*).

FIELD CROPS.

Records of certain experiments conducted by collegiate centers aided by the Board of Agriculture (*Bd. Agr. [London], Rpt. Agr. Ed. Great Britain, 1897–98, pp. 37–127*).—The work here reported comprises fertilizer and rotation experiments carried on for different lengths of time at various agricultural institutions in Great Britain. Fertilizer tests were made with cereal, root, and hay crops and with grasses in permanent meadows and pastures. The results are given in tables and discussed.

Culture and fertilizer experiments with hops in 1897 showed that an application of 10 cwt. of mixed superphosphate and ground Carolina phosphate gave the best results. The amount of soft resins in the hops increased with each increase in the application of phosphates. Potash as a fertilizer decreased the crop and reduced its quality. Applications of lime gave an increase in yield of 14 per cent. The East Kent system of training the hop vines gave the best crop as compared with 5 other systems. Different methods of cultivation had practically no effect on the yield, but deep cultivation at the end of the season gave a low percentage of soft resins. Temperatures of hop drying are shown in diagrams. It is concluded that in general the results indicate that the percentage of soft resins is increased by applications of phosphatic fertilizers and diminished by applications of potash and late nitrogenous dressings.

Alfalfa, Spanish peanuts, unknown cowpea, and velvet beans, W. C. STUBBS (*Louisiana Stas. Bul. 55, 2. ser., pp. 107–123*).—This bulletin reports the results of field and laboratory investigations on the legumes enumerated in the title, and gives a brief description including cultural notes of each crop. The report of the experiments is prefaced with a discussion of the use and value of leguminous crops in connection with farming in the South. The following table gives the composition of alfalfa grown at Calhoun, Louisiana:

Composition of different cuttings of alfalfa based on the air-dried substance

	Moisture.	Protein.	Ether extract.	Nitrogen-free extract.	Crude fiber.	Ash.	Fertilizing constituents.		
							Nitrogen.	Phosphoric acid.	Potash.
	Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
First cutting, May 9	9.73	14.75	2.65	40.24	24.25	8.38	2.36	0.61	2.49
Second cutting, June 8	10.04	18.06	2.40	37.87	24 00	7.63	2.89	.68	2.57
Third cutting, July 1	11.73	19.46	2.20	33.01	24.85	8.75	3.11	.72	3.42
Fourth cutting, Aug. 1	13.45	15 46	2.11	35.69	25.60	7.79	2.47	.65	2.91

The comparative merits of Spanish peanuts, unknown cowpea, and velvet beans for fertilizer or forage purposes were studied. When the analyses were made the peanuts were matured, while the cowpeas and velvet beans contained but a few rudimentary pods. The yields and fertilizing ingredients are given in the following tables:

Comparative yield per acre of Spanish peanuts, unknown cowpea, and velvet beans.

Parts of plant.	Green.			Air dry.			Dry matter.		
	Spanish peanut.	Unknown cowpea.	Velvet bean.	Spanish peanut	Unknown cowpea.	Velvet bean.	Spanish peanut.	Unknown cowpea.	Velvet bean.
	Lbs.	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*
Vines and leaves	9,066	15,261	18,736	2,658	3,665	4,113	2,435	3,242	3,720
Fallen leaves	708	2,030	4,183	559	1,881	3,382	500	1,683	2,985
Roots	478	1,757	965	190	421	173	170	378	151
Fruit	5,254	....	....	3,673	....	....	3,480	....	....

Fertilizing ingredients per acre in the total air-dried crop of Spanish peanuts, unknown cowpeas, and velvet beans.

	Spanish peanuts.				Unknown cowpea.				Velvet beans.			
	Nitrogen.	Phosphoric acid.	Potash.	Lime.	Nitrogen.	Phosphoric acid.	Potash.	Lime.	Nitrogen.	Phosphoric acid.	Potash.	Lime.
	Lbs.	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs*	*Lbs.*
Vines and leaves	33.75	6.11	60 60	48.64	67.80	18.32	98 58	23.45	93.36	19.74	143.13	61.69
Fallen leaves	6.48	84	5.20	18.78	36.11	5.64	15.04	64 33	58 17	15 89	33.14	112.95
Roots	2.24	.44	3.11	1.80	4.59	1.38	9.21	2 65	2.66	.65	40.48	1 85
Fruit	150.22	28 28	23.87	5.14	......	......	.....	.....	......	......	......	......
Total	192.69	35 67	92.78	74.36	108.50	25.34	122.83	90.43	154.19	36.28	216.75	176.49

Velvet beans, J. F. DUGGAR (*Alabama College Sta. Bul. 104, pp. 109-125*).—This bulletin reports the results of experiments with velvet beans for soil improvement. An introductory statement regarding the plant in general is made, and the uses of the beans as human food and food for live stock are noted. A comparison of the yield of hay from velvet beans and cowpeas is also shown.

Sorghum was grown on 3 plats, on 2 of which cowpeas and velvet beans had been plowed under. The plats were fertilized with acid phosphate and muriate of potash, and the crops of cowpeas and velvet beans were intended to supply the nitrogen. The increase of sorghum on the cowpea plat over the plat on which no leguminous crop had been plowed under was at the rate of 3,216 lbs. per acre, and the increase on the velvet-bean plat at the rate of 3,272 lbs. per acre.

Velvet beans grown on poor soil fertilized at the rate of 240 lbs. of acid phosphate and 48 lbs. of muriate of potash per acre yielded 19,040 lbs. of green material per acre. The weight of the hay after 5 days' curing was 8,240 lbs. The weight of the roots and stubble, excluding fallen leaves, was 1,258 lbs. The beans were planted April 20 in rows 3½ ft. apart at the rate of 110 lbs. per acre, and harvested October 12, when they were too mature to make good hay. Determinations based on analyses show that the hay per acre contained 188.7 lbs. of nitrogen and the roots and stubble 12.5 lbs. The author states that this amount of nitrogen is equal to the amount contained in about 2,800 lbs. of cotton seed meal. The cured vines contained 2.29 per cent of nitrogen and the air-dried roots 1 per cent.

The average yield of hay per acre from velvet beans and Wonderful cowpeas sown broadcast and in drills and grown on different kinds of soil was 5,183 and 5,477 lbs., respectively. It is thought best to plant velvet beans in drills at the rate of about 1 bu. of seed per acre.

Soil improvement by velvet beans and cowpeas as measured by increased yield of oats is reported from a previous bulletin (E. S. R., 10, p. 739).

Cultural experiments with beets in the years 1896 and 1897, SCHINDLER (*Separate from Oesterr. Ungar. Ztschr. für Zucker Ind. u. Landw., 1898, No. 5, pp. 36, pls. 5; abs. in Bot. Centbl., 78 (1899), No. 8, pp. 218-251*).—From experiments with *Beta maritima* and *B. vulgaris*, the investigator, E. von Proskowez, concluded that all the different forms tested belong to one species, the variations having their origin in the conditions of environment, and that the cultivated varieties are derived from this species. The transition from native to cultivated forms was observed to be rapid and every generation showed improvement. Progress in culture and breeding experiments with 3 varieties or forms of beets from India is reported.

Experiments on premature seed production of beets, A. CSERCHÁTI (*Bl. Zuckerrubenbau, 6 (1899), No. 4, pp. 49-57*).—These experiments were made to determine the influence of the time and depth of planting, the size of the seed, and the variety of the beet on premature seed production. It was found that planting prematurely-produced seed resulted in more plants producing seed the first year than when seed from normal beets was used, and that the tendency was not the same for all varieties. The longer the weather conditions interfered with the growth of the plant the greater was the percentage of beets producing seed the first year, and the variety, early planting, and the use of prematurely-produced seed were factors which seemed to give impetus to this tendency.

Best varieties of corn, J. H. CONNELL and B. C. PITTUCK (*Texas Sta. Bul. 49, pp. 1188-1201, fig. 1*).—The subject of varieties of corn best suited to different sections of Texas is discussed in a popular manner. Late and medium early varieties are briefly described and the number of days required to mature them when tested is given. The conditions of soil and climate in relation to corn culture in different parts of the State are considered, and the rainfall and daily mean temperature for the year are recorded.

For milling and feeding purposes the author recommends Welborn Conscience, Mosby Prolific, White Southern Bread, and Mexican June corn.

Field tests with corn at College Station and Beeville Substation, B. C. PITTUCK (*Texas Sta. Bul. 49, pp. 1177-1187, pl. 1*).—Results of variety tests and of experiments in planting corn at different distances in 1898 are given in tables, and the yields for 1895, 1896, and 1898 are compared. The methods of cultivation are described.

At the station 42 varieties were grown. Blount Prolific, St. Charles White, and Southern White Gourd Seed were the most productive varieties, yielding 40.7, 39.5, and 37.2 bu. per acre, respectively. The seed of Blount Prolific had been grown in Virginia, the seed of St. Charles White in Illinois, and that of Southern White Gourd Seed in Delaware. A comparison of the yields of varieties grown for 3 or 4 years showed that Blount Prolific gave the largest average yield. "This indicates the pressing need of more distinctly southern-grown seed corn."

Among 25 varieties tested at the Beeville Substation under different soil and weather conditions, these same varieties produced the largest yields. This season corn planted 4½ by 2½ ft. gave the best results. The same results were obtained in previous investigations on the distance of planting.

Farm manures for cotton, C. M. CONNER (*South Carolina Sta. Bul. 40, pp. 8*).—This bulletin reports fertilizer experiments with farm manures and commercial fertilizers during one season on sixteenth-acre plats. Barnyard manure was compared with cotton-seed products and with a compost. The compost was mixed in the proportion of 600 lbs. each of barnyard manure, cotton-seed meal, and acid phosphate, and 200 lbs. of kainit. In computing the results the lint was valued at 5 cts. per pound and the seed at $9 per ton. The money value of the increase per acre of lint and seed with the application of the different manures was as follows:

2,714 lbs. per acre of manure from cows fed on cotton-seed meal and hulls	$10.88
145 lbs. of cotton-seed meal and 580 lbs. of cotton-seed hulls per acre	2.73
2,960 lbs. per acre of manure from mule stables	5.93
5,428 lbs. per acre of manure from cow barns	6.23
1,320 lbs. compost per acre	14.81
2,640 lbs. compost per acre	22.74

When acid phosphate was used at the rate of 192 lbs. per acre in addition to the manure from mule stables and at the rate of 292 lbs. per acre with the other applications, the value of the increase over no fertilizer was as follows:

Manure from cows eating meal and hulls	$12.36
Cotton-seed meal and hulls	10.91
Manure from mule stables	10.12
Manure from cow barn	13.65

Leguminous plants and the fertilizers which they require (*L'Engrais, 14 (1899), Nos. 6, pp. 134–136, figs. 3; 8, pp. 182–185, figs. 4; 10, pp. 232–234*).—A brief history of the experiments with leguminous plants is given, and the results of various investigations on this subject are summarized. It is concluded that leguminous plants remove from the soil of meadows large quantities of nitrogen, phosphoric acid, potash, and lime, but that it is unnecessary to apply nitrogenous fertilizers. In the experiments referred to barnyard manure applied directly did not produce as good results as commercial fertilizers, and hence it is recommended that barnyard manure be applied to other crops in the rotation. For soils of medium fertility an application of 300 to 400 kg. of superphosphate or Thomas slag and 150 to 200 kg. of muriate of potash per hectare is recommended.

On soils rich in potash it is recommended to replace a portion of the potash fertilizer by gypsum or carbonate of lime.

Experiments with oats, J. F. HICKMAN (*Ohio Sta. Bul. 101, pp. 161–179, 181–183*).—These experiments comprise variety, seed, and culture tests. During the seasons of 1896, 1897, and 1898, 66 varieties of oats were tested. These varieties are classified into 4 groups: Welcome, Seizure, Wideawake, and a division known as the Mixed group. The Welcome group includes varieties having an open panicle, coarse but usually weak straw, and short, plump grain; the Seizure group comprises those varieties in which the head is more or less one-sided and which are usually known as side oats; and the Wideawake group, those varieties which have a general resemblance to the Welcome class but have a longer, more pointed, and usually lighter berry and a stronger straw. Under the remaining group the author classifies a number of black and mixed groups similar to the Welcome group but usually lighter.

The average yield per acre for 3 years of the Welcome, Seizure, and Wideawake groups, including duplicate plats, was 54.33, 52.33, and 50.99 bu., respectively. The highest average yields for 6 years were produced by the following varieties in the 3 named groups: In the Welcome group, Lincoln, Improved American, Clydesdale, White Belgian, and Kernel; in the Seizure group, Early Swedish, White Swiss, Wilson Prolific, Egyptian, and Japan; and in the Wideawake group, Banner, White California, Alabama, and Kansas Hybrid.

Early Archangel and Hargett White have given the highest average weight per bushel. Early varieties are regarded as usually having weaker straw and being less productive than late maturing sorts. The latest varieties, however, were found not to yield quite as well as those ripening at the intermediate period.

Rolling the ground before seeding gave results apparently better than rolling after seeding. Covering the seed about 1 in. deep was found preferable to deeper covering. Preparing the seed bed by plowing gave better results than simply stirring the surface; while cultivating the seed in, without any preparation of the soil, gave poorer results than either of the other methods.

Mixing several varieties of oats for seed was not found profitable. The selection of heavy seed did not increase the yield of grain but gave better yields of grain and straw than light seed under the same conditions. The results of 2 years' experiments indicate that new seed gives better yields of grain and straw than seed one year old.

Third potato report, F. W. RANE (*New Hampshire Sta. Bul. 63, pp. 39-73, figs. 8, map 1*).—This bulletin is a report of variety tests of potatoes carried on at the station and on different farms throughout the State. Individual reports are given for the cooperative tests. Previous reports in this series have been noted (E. S. R., 9, p. 45; 10, p. 432). This season 104 varieties were tested, 80 of these having been described in former reports. In this bulletin descriptions are given of varieties not previously described. The following varieties, mentioned in the order of their productiveness, have given the largest average yield for the years 1896-1898: Reeve Rose, White Beauty, Vaughan, Red American Wonder, Late Puritan, Sir William, Seneca Beauty, Harvest Queen, Sir Walter Raleigh, Fillbasket, Woodhull Seedling, Dewdrop Rose, Breck Chance, Prolific Rose, Orphan, White Rose, and Wilson First Choice. Of these varieties White Beauty, Red American Wonder, Breck Chance, and Prolific Rose have been grown for one season only.

Commercial fertilizers for potatoes, II, W. H. JORDAN (*New York State Sta. Bul. 154, pp. 335-345*).—The work here reported is in continuation of previous experiments (E. S. R., 10, p. 431), and on a similar plan. In 1898 the application of 1,500 lbs. of fertilizer per acre gave the best financial results. The Long Island formula increased the yield 6.3 bu. per acre over the formula based on the composition of the potato.

The new tests were made on 64 eighth-acre plats on 4 different farms. The object of this work was to ascertain the effect of the amount of potash furnished in either the "potato" or the Long Island formula as compared with ⅔ as much, ⅓ as much, or no potash at all. Variations of the amount of potash showed no influence.

Sugar-beet experiments during 1898, A. J. McCLATCHIE and R. H. FORBES (*Arizona Sta. Bul. 30, pp. 190–225*).—During this season the work was conducted as previously outlined (E. S. R., 9, p. 833). The results are reported from summer-sown and winter-sown plats. The temperature record for 1898 is given in a table, and the field work of the season is discussed. The soil of each plat and the methods of cultivation are described. Analyses of the water and limestone supplies of Arizona are reported in connection with a consideration of factory requirements. The average results of 10 plats varying from ⅛ to ¾ acre in size, and located on 10 different farms near Phenix, showed a yield of 12.85 tons of beets per acre, a sugar content of 13.8 per cent, a purity coefficient of 78.53, and a yield of 2,438 lbs. of sugar per acre. It is concluded that early planting is essential and that the best time for planting is from January 1 to February 15.

The sugar beet in Indiana in 1898, H. A. HUSTON and A. H. BRYAN (*Indiana Sta. Bul. 75, pp. 20, fig. 1*).—Previous work in this line has been reported in a former bulletin (E. S. R., 10, p. 143). The present bulletin gives a statement of the results obtained in 1898 and a discussion of the climatic conditions for the season. An unfavorable combination of weather conditions interfered with the experiments, and the results are considered unsatisfactory to some extent. The general conditions of the season favored a high yield with a low sugar content. Beets of good quality, however, were produced in many parts of the State. The results varied considerably and no averages are given.

Sugar beets, J. T. WILLARD and R. W. CLOTHIER (*Kansas Sta. Bul. 83, pp. 16*).—This bulletin is a report on the cooperative culture experiments with sugar beets in 1898. Similar work has been previously reported (E. S. R., 10, p. 346). Directions are given for the culture of sugar beets, and the results of analyses are tabulated. Experiments for the coming season are outlined. The results for the season show an average sugar content in the juice of 11.56 per cent and a coefficient of purity of [illegible]7.8 per cent. The average weight of the beets in the samples was 1.45 lbs. The average yield was estimated at about 16 tons per acre. Considering only those plats which were ¼ or ½ acre in size, the sugar content was 12.7 per cent and the purity 83. The author concludes from his observations that the seed should be planted before May 1, in rows 16 to 21 in. apart and in soil such that the roots can be kept from growing above the ground to any extent.

The sugar beet, H. W. WATERS (*Missouri Sta. Bul. 45, pp. 20–32*).—Cooperative tests in the culture of sugar beets were carried on in 1898 as in previous years (E. S. R., 9, p. 944). This bulletin reports the results obtained in 1898, reviews previous experiments in this line, and describes the weather conditions for the season. From 69 out of 114 counties in the State 150 samples of beets were obtained for analysis. The average weight of the beets in the samples was 24 oz.; the average per cent of sugar in the juice, 8.73; and the average coefficient of purity, 72.52. Only 5 samples contained 12 per cent of sugar in the beet. The percentage of sugar in the juice ranged from 3.72 in a sample from Montgomery County to 14.58 in a sample from Atchison County.

Sugar-beet investigations for 1898, J. L. STONE ET AL. (*New York Cornell Sta. Bul. 166, pp. 417-467, pls. 3, figs. 2*).—This bulletin reports observations and conclusions based upon a study of field conditions in growing sugar beets, results obtained in sugar-beet culture at the station, and results of analyses of beets grown in various parts of the State. A comparison of the weather conditions of 1897 and 1898 shows that the season of 1898 was not favorable to the best results in sugar-beet culture. Previous experiments along this line have been reported in a former bulletin (E. S. R., 10, p. 143).

The observations made in the cooperative tests with sugar beets during this season show that the heavier soils were more favorable than the lighter soils, and that the more fertility and tillage a crop requires the better it is suited to prepare the land for a crop of beets. The reported yields average 12.98 tons per acre. An average of 14 tons of trimmed beets per acre was obtained by 152 farmers who had grown 252 acres of beets for sugar manufacture. The average cost of growing an acre of beets as estimated by 45 farmers is $38.15, and the average cost per ton, based on 43 estimates, is $3.25. The results of a number of cooperative fertilizer experiments show that, while in some instances the fertilizers applied were very effective, the average increase in yield was not so marked. The quality of the beets was not perceptibly affected by the application of fertilizers.

The work at the station comprised distance, tillage, thinning, subsoiling, and fertilizer experiments, and variety tests. Beets planted in rows 20 in. apart yielded 2 tons per acre more than beets grown in rows 24 in. apart. In the tillage tests cultivating 5 times gave a better yield than cultivating either 4 or 6 times. Beets planted May 11 were thinned June 3, 10, and 17, and yielded 22.3, 23, and 28 tons per acre, respectively, for the different dates of thinning. It is concluded that when conditions are favorable considerable range may be taken as to time of thinning. Subsoiling immediately before planting increased the yield at the rate of 2.9 tons per acre. The authors recommend that when subsoiling is done during the season of planting it be done early enough to give ample time for the restoration of capillarity before the dry weather of summer.

Among 9 varieties Kleinwanzlebener gave the largest yield per acre and Pitzschke Elite the highest percentage of sugar in the juice. The results of fertilizer experiments indicate that nitrate of soda applied alone is conducive to the growth of large beets of poor quality.

The average results of the analyses of 496 samples of sugar beets grown in 1898 show the following percentages: Solids in the juice, 18.30; sugar in the juice, 15.29; sugar in the beet, 14.53; and purity, 83.60.

Sugar-beet investigations in 1898, L. L. VAN SLYKE (*New York State Sta. Bul. 155, pp. 347–373*).—This bulletin reports the results of experiments with sugar beets undertaken by the station in cooperation with 17 farmers in 10 different counties. Previous work in this line has been reported in a former bulletin (E. S. R., 10, p. 145). The results of the cooperative culture experiments for the season are given in the following table:

Results of culture experiments with sugar beets.

	Yield per acre.	Sugar in the beet.	Purity.	Weight of beets	Cost of growing beets		Value of crop per acre.
					Per acre	Per ton.	
	Pounds	*Per cent*	*Per cent.*	*Ounces.*			
Minimum	8,670	10.1	72.5	5.0	$33.34	$2.60	$18.42
Maximum	58,990	18.5	87.3	27.0	108.86	10.00	95.86
Average	26,720	15.5	82.3	15.7	59.87	4.50	63.46

In connection with these cooperative tests, fertilizer experiments were carried on to test the effect of fertilizers on the yield, quality, and cost of sugar beets. The fertilizer consisted of 1,000 lbs. acid rock, 350 lbs. sulphate of potash, 450 lbs. dried blood, and 200 lbs. nitrate of soda, and was applied at the rates of 500 and 750 lbs. per acre. The smaller application gave an average increase in yield of 3,874 lbs. per acre and the larger application an increase of 5,264 lbs. The use of 500 lbs. did not affect the sugar content and proved most economical. The heavier application caused an average decrease of 0.5 per cent in sugar content. The use of fertilizers had little effect upon the purity.

The 343 samples obtained from 33 counties and analyzed at the station gave an average percentage of 14.2 of sugar in the beet with a purity of 85.

Some special investigations were made at the station and also at a farm near Fayetteville to study the effect of different amounts of commercial fertilizers and the use of 20 tons of stable manure per acre. The influence of growing beets at different distances in the row was also investigated. The fertilizer mixture employed consisted of 200 lbs. nitrate of soda, 200 lbs. dried blood, 150 lbs. acid rock, and 150 lbs. sulphate of potash. The use of 500, 1,000, and 1,500 lbs. of this mixture per acre increased the yield, while 2,000 lbs. gave a smaller yield than applying 1,000 lbs. The sugar content was reduced 1 per cent by the use of each of the 3 smaller applications as compared with beets grown without fertilizers. The smallest application gave the largest profit, and when 1,500 lbs. or more were used there was a loss. The results further show that the size of the beets was increased and the purity slightly decreased.

The use of stable manure gave an average increase in yield of 8,720 lbs. per acre and of 1.5 and 1.6 per cent in sugar content and purity, respectively. The beets were decreased an average of 2.75 oz. in weight.

The results of growing beets at different distances in the row show that there was an increase in yield, purity, and size of beets as the distance increased from 6 to 10 in. The variation in the percentage of sugar was very small.

Among a number of varieties of sugar beets investigated Pitzschke Elite gave the best returns, yielding at the rate of 43,736 lbs. per acre, with a sugar content of 14.2 per cent in the beet and a purity of 84.1. Vilmorin French Very Rich produced the richest beets, the percentage of sugar in the beet being 14.7 and the purity 84.6. Kleinwanzlebener beets from seed grown in New York contained 12.7 per cent of sugar, with a purity coefficient of 81.9.

Sugar-beet investigations in 1898, J. H. STEWART and B. H. HITE (*West Virginia Sta. Bul. 55, pp. 79–93*).—This bulletin reports the results of cooperative culture experiments with sugar beets in different sections of the State. The results of analyses of 125 samples are tabulated and popular directions for the culture of the crop are given. The average sugar content of the juice in the samples from different counties varied from 7.39 to 17.35 per cent and the purity from 57.4 to 82.2 per cent.

Experiments with commercial fertilizers were made at the station on a series of 9 plats. The results showed considerable variations. Nitrate of soda decreased the sugar content and lime decreased both the sugar content and the purity. The average analyses of 238 samples grown within the State show a sugar content of 13.4 per cent and a purity coefficient of 76.7 per cent.

Report of the agriculturist and horticulturist, A. J. McCLATCHIE (*Arizona Sta. Rpt. 1898, pp. 182–189, pl. 1*).—This is a report on the work of the agricultural and horticultural department of the station. The cooperative work with sugar beets and the experiments with date palms, wheat, cowpeas, and melons at the Phenix Substation are briefly discussed.

Field experiments at Ghent, Belgium, P. DE CALUWE (*Exposé Cult. Exper. Jard. Gand, 1896–97, pp. 75, plan 1*).—This publication is the annual report on experiments in progress at the experiment garden of the Province of East Flanders. Fertilizer, culture, and variety tests with rye, wheat, barley, oats, maize, peas, flax, sugar beets, turnips, potatoes, and grasses are reported. Comfrey and sachaline were grown experimentally and fertilizer tests were made upon natural meadows. Daily meteorological observations for the year beginning October 1, 1897, are tabulated. Similar work has been previously reported (E. S. R., 9, p. 349).

It was found that injuries to rye due to fertilizing with nitrate of soda were overcome as the crop reached maturity, provided the injury was not too marked. The injury was noticed to affect the yield of straw more than the yield of grain.

Fifth annual report on field experiments, 1898, D. A. GILCHRIST (*Jour. Reading Col., England, Sup. 6, pp. 80*).—This is a report on the work for the season of 1898 in

Berkshire, Dorset, Hampshire, and Oxfordshire, England. The field experiments consisted mainly of fertilizer tests on most of the principal farm crops, including grasses in meadows and pastures, wheat, root crops, potatoes, sainfoin, and lucern. The effects of manures throughout entire rotations were studied. Suggestions for the manuring of various crops and notes on different fertilizing substances are given. The results obtained by each experimenter are reported separately but no general conclusions are drawn.

Alfalfa by irrigation, J. SHOMAKER (*Amer. Farmer Mag., 6 (1899), No. 1, pp. 38–40, figs. 2*).—A popular article on the subject.

Arrowroot, A. J. BOYD (*Queensland Agr. Jour., 4 (1899), No. 5, pp. 335–339, pl. 1*).—An article on the culture of arrowroot and the process of obtaining its starch.

The importance of the selection of varieties and of the condition of the crop at harvesting time in the production of barley for brewing purposes, H. FALKENBERG (*Centbl. Agr. Chem., 28 (1899), No. 4, pp. 264–267*).—An abstract of a lecture on this subject by T. Remy.

Report on tests of smooth brome grass (Bromus inermis), T L. LYON (*Nebraska Sta. Bul. 57, pp. 37–45*).—Cooperative experiments with smooth brome grass were made by 33 parties in different parts of the State. Brief reports of 29 trials are given. Of these, 13 were favorable, 10 unfavorable, and 6 doubtful. No conclusions are drawn.

The cultivation of broom corn, D. JONES (*Queensland Agr. Jour., 4 (1899), No. 6, pp. 424–426*).—Popular suggestions on the culture of broom corn in Queensland. A number of varieties are described.

Buckwheat, H. A. TARDENT (*Queensland Agr. Jour., 4 (1899), No. 5, pp. 327–331, fig. 1*).—A popular article on the culture and uses of buckwheat and its distribution.

Cañaigre, R. H. FORBES (*Arizona Sta. Rpt. 1898, pp. 174–178, fig. 1*).—Culture experiments with cañaigre to test the effect of different sorts of seed roots, depths of planting, soils, fertilizers, and dates of harvesting on yield were made during the season. The results, taken as a whole, were contradictory; but data taken from what are considered the more reliable portions of the field show that old roots gave better yield than new roots, that small new roots were more productive than large new roots, that the yield from the second year harvest was nearly double that from the first year harvest, and that the best yield in the field was produced on the plat receiving the nitrate of soda

Manual of coffee culture, M. S. BERTONI (*Rev. Agr. Cien. Apl., Paraguay, 1 (1897), Nos. 1, pp. 1–27; 2, pp. 49–71; 4, pp. 145–159; 6, pp. 241–255*).—This article treats in a popular way of coffee culture in Paraguay.

Hybrid coffee (*Planting Opinion, 4 (1899), No. 23, p. 139*).—A note on the advantage of hybridizing coffee and the difficulties in the way of such work.

Experiments with corn and cotton, H. BENTON (*Alabama Canebrake Sta. Rpt. 1898, pp. 12–15*).—Among 4 varieties of corn Welborn Conscience was the most prolific. Tests of deep and shallow cultivation for corn and cotton did not give conclusive results in 1897 and 1898. Among 6 varieties of cotton Truitt gave the best returns. Cultivating cotton weekly gave better results than cultivating once every 2 weeks. A partial report on an experiment with leguminous crops is given, but no conclusions are drawn.

Report of the retting of flax by the Doumer-De Swarte process, E. DIXON (*Bul. [Min. Agr. France] 18 (1899), No. 3, pp. 293–296*).—This report gives a description of the method and the necessary apparatus for this system of retting and points out its advantages. A comparison was made of flax retted by this process and flax retted in the Lys. The Lys retted flax was inferior in fineness, strength, and color of fiber.

On the growth and future of flax culture and the flax industry in Sweden, G. A. SELLERGREN (*K. Landt. Akad. Handl., 38 (1899), No. 1, pp. 23–36*).

Ginseng (*Bul. Bot. Dept. Jamaica, 6 (1899), No. 6, pp. 87–89*).—Popular notes on the culture, distribution, and market value of ginseng.

Experiments with grasses for lawn, pasture, or hay, H. M. SESSIONS (*Proc. Columbus Hort. Soc., 13 (1898), pp. 24–27*).—Notes are given of two series of experiments with about a dozen species of grasses and clovers, testing their relative value for the above purposes. The first series was conducted at Atlanta, Georgia, and the second at Tougaloo, Mississippi. The different grasses are grouped, showing their value for lawns, hay, etc.

On the practical valuation of oats, N. H. NILSSON (*Tidskr. Landtmän, 20 (1899), No. 9, pp. 145–152*).

Experiments in acclimatizing winter oats, SCHACHT (*Deut. Landw. Presse, 26 (1899), No. 45, pp. 515, 516*).—An article containing suggestions on the methods of conducting experiments in acclimatizing winter oats.

Irish potato culture, A. B. MCKAY (*Mississippi Sta. Bul. 54, pp. 8*).—Popular directions are given for the culture of spring and fall crops of potatoes. The topics discussed are soil, drainage, plowing, subsoiling, fertilizers and their application, time and method of planting, cultivation, harvesting, and storing during summer. Early Rose, Peerless, Red Triumph, and Beauty of Hebron are considered desirable varieties for Mississippi.

The potato, W. SOUTTER (*Queensland Agr. Jour., 4 (1899), No. 5, pp. 332, 333*).—A brief article on potato culture, with several references to its history.

Profitable potato fertilizing, II, F. H. HALL and W. H JORDAN (*New York State Sta. Bul. 154, popular ed., pp. 4*).—A brief popular review of Bulletin 154 of the station (see p 235) on commercial fertilizers for potatoes.

Fertilizer experiments with cereals and potatoes at Luleå chemical plant-physiological station, 1897 (*Meddel. K. Landtbr. Styr., 1898, No. 6, pp. 330–348*).

Root crops (*Queensland Agr. Jour., 4 (1899), No. 6, pp. 417, 418*).—Popular notes on the culture of carrots, parsnips, turnips, and beets.

Sugar-beet experiments, H. BENTON (*Alabama Canebrake Sta. Rpt. 1898, p. 9*).—"The analysis of the large beets showed only 3.7 per cent of cane sugar, while the smaller beets contained 5.1 per cent sugar."

Sugar-beet success for the season, F. H. HALL and L. L. VAN SLYKE (*New York State Sta. Bul. 155, popular ed., pp. 8*).—This is a brief popular review of Bulletin 155 of the station (see p. 238).

Sugar-beet experiments, E. F. LADD (*North Dakota Sta. Bul. 35, pp. 325–327*).—A brief account is given of the sugar-beet work carried on by the station during different seasons. In 1898 the analysis of 15 samples grown in the State showed an average of 14.38 per cent of sugar in the juice and a purity of 79.4.

Experiments in the growth of sugar-beet root in Great Britain (*Jour. Bd. Agr. [London], 6, No. 1, pp. 45–55*).—This article discusses sugar-beet culture in Great Britain in 1898 and gives tabulated statements of cooperative experiments carried on during the season. The average results of samples analyzed show a sugar content of 15.65 per cent in the juice, with a purity of 85.19.

The present status of the knowledge of fertilizing for sugar cane in Java, J. D. KOBUS (*Orgaan Ver. Oudleer. Rijks. Landbouwschool, 11 (1899), No. 132, pp. 111–115*).—A paper on the subject reviewing the experimental work in this line.

The Florida velvet bean, E. F. LADD (*North Dakota Sta. Bul. 35, pp. 329, 330*).—A culture test with the Florida velvet bean and an analysis of the plant are reported. The plants grew about 18 in. high and were in bloom at the time of the first frost in early autumn Peas grown under like conditions with the velvet beans contained 3.6 per cent of nitrogen in the air-dry substance, while the beans contained 2.57. The author does not consider velvet beans valuable for North Dakota.

Wheat culture, M. S. BERTONI (*Rev. Agr. Cien. Apl., Paraguay, 1 (1899), No. 4–5, pp. 229–233*).—A report on variety tests with wheat at Assuncion, Paraguay.

On the origin and descent of the different kinds of wheat, N. WILLE (*Tidsskr. Norske Landbr., 6 (1899), No. 3, pp. 130–137*).

Notes on the milling qualities of the varieties of wheat most commonly grown in New South Wales, F. B. GUTHRIE (*Agr. Gaz. New South Wales, 10 (1899), No. 6, pp. 518–525*).

Catch cropping in Scotland, R. P. WRIGHT (*Trans. Highland and Agr. Soc. Scotland, 5. ser., 11 (1899), pp. 1–39*).—This article describes the methods and practical advantages of growing catch crops. Directions are given for growing the following crops as catch crops: Italian rye grass, rye, barley, vetches, clovers, rape, mustard, kale, cabbage, and white turnips.

Experiments in acclimatizing foreign plants in Paraguay and Argentina, M. S. BERTONI (*Rev. Agr. Cien. Apl., Paraguay, 1 (1899), No. 4–5, pp. 224–229*).—The experiments are described and the results thus far obtained are noted.

New plants for Paraguay, J. KRIESE (*Rev. Agr. Cien. Apl., Paraguay, 1 (1899), No. 9–10, pp. 414–422*).—The article considers species of Sesamum, Ricinus, Rhus, Cæsalpinia, Manihot, Aleurites, Stillingia, and Bassia.

Plants from dry regions and their culture in Paraguay, J. KRIESE (*Rev. Agr. Cien. Apl., Paraguay, 1 (1899), No. 8, pp. 364–370*).—A popular article on the adaptation of certain plants growing in dry regions to the conditions existing in Paraguay.

Haymaking, P. WAGNER (*Braunschw. Landw. Ztg., 67 (1899), No. 25, pp. 116–119; Ztschr. Landw. Ver. Hessen, 1899, No. 25, pp. 318–320*).—A popular article calling attention to the results that should be obtained in making hay. Methods of haymaking are discussed.

HORTICULTURE.

Plants starved by excessive feeding, E. COURTOIS (*Bul. Chambre Syndicale Hort. Maraîchers Amiens, 1898, Dec.; Rev. Hort., 77 (1899), No. 8, pp. 182, 183; Garden, 55 (1899), No. 1432, p. 281*).—A statement of the principles of osmosis as exhibited in the living plant cell, and an exposition of their economic application in fertilizing plants with liquid manures. In order that the endosmotic current may be the stronger and more rapid the liquid absorbed by the roots must be less dense than the cell sap. Since cell sap contains about 4 gm. of soluble matter to the liter, a liquid fertilizer must contain less than that proportion. In practice this amount should not be over 2 to 3 gm. to the liter. In respect to the amount of water or liquid manure that should be applied to plants, especially in pots, it is stated on the basis of investigations that this amount should be one and two-thirds of what the plant is able to absorb.

Tomatoes, cabbage, and onions, C. L. NEWMAN (*Arkansas Sta. Bul. 56, pp. 21*).—Experiments in transplanting tomatoes are reported. Seeds of 10 varieties were sown January 1 ½ in. deep in rows 3 in. wide. Ten plants of each variety were subjected to different treatments after the first rough leaf appeared up to the time they were transferred to their permanent place in the field. The treatment of the different lots was as follows:

"*Plat 1.*—When the third or first rough leaf appeared the plants were shifted to other flats and set 1 by 1 in. Before they became crowded they were again shifted to flats and set 3 by 3 in. Each plant was taken up with its allotted portion of soil. . . . When the 3 by 3 in. plants began crowding they were again cut out and shifted to quart strawberry boxes, where they remained until transplanted in the field on March 30. . . . In transplanting to the field the plants were not taken from the berry boxes, but set box and all so that the top of the box was 4 in. beneath the surface of the ground. . . .

"*Plat 2.*—The treatment of this lot of plants was identical with those of plat 1 up to the time they were transferred to the strawberry boxes. Instead of the berry boxes flats 3½ in. deep were used, the plants being set 4 by 4 in., where they remained until the final transplanting on March 30, when a block of soil 4 by 4 by 3½ in. was removed with the plants. The plants were set as were those in the berry boxes, 4 in. deeper than they had grown in the flats. . . .

"*Plat 3.*—This lot of plants was treated as lots 1 and 2 up to the shift to 3 by 3 in. into flats, where they remained until the final transplanting on March 30, when, with a 3-in. square of earth, they were set 4 in. deeper than they stood in the flats. . . .

"*Plat 4.*—These plants were shifted to 2-in. pots when the first rough leaf appeared, and later to 3-in pots, from which they were transferred to the field on March 30 and set so that the top of the ball of earth was 4 in. below the surface of the ground. . . .

"*Plat 5.*—These plants were not disturbed until the final transplanting of March 30. They . . . were set 4 in. deeper than they stood in the flats. . . .

"*Plat 6.*—These plants were treated the same as plat 5, except that they were set only as deep as they grew in the trays."

The results are summarized in the following table:

Average results of experiments with tomatoes.

	Average number of fruits per plant that ripened before July 1.	Average weight per plant.	Average weight of tomatoes.	Average weight of largest tomatoes.	Yield per acre in bushels—50 lbs. to bushel.
	Pounds.	*Pounds.*	*Ounces.*	*Ounces.*	*Bushels.*
Plat 1	18.81	6.90	5.85	10.5	500.94
Plat 2	17.61	6.12	5.45	10.3	444.31
Plat 3	18.48	5.82	4.95	7.5	422.53
Plat 4	12.30	3.65	4.61	6.8	264.99
Plat 5	17.39	3.40	3.34	5.3	246.84
Plat 6	13.02	2.26	2.80	3.9	164.07
Average	16.26	4.69	4.50	7.38	340.49

Plat 1 ripened first and plats 5 and 6 last. The difference in yield between plats 1 and 6 is 336.87 bu. per acre, yet the total difference in cost of growing the fruit was less than $20 per acre. These results indicate that "the productiveness, size, and earliness of the fruit are proportionate with the vigor of the young plants and that the vigor of the plants is controlled by their early treatment."

Experiments were made in thinning tomatoes to increase the size of the fruit. The test was conducted with 2 lots of 25 plants each. In lot 1, not more than 3 fruits were allowed to remain on 1 cluster, and generally only 2. The thinning was done when the young tomatoes were ½ or ¾ in. in diameter. The other lot was not thinned. The total weight of fruit per vine was a little less when the fruit was thinned than when it was not thinned, but the average weight of a single fruit in the former case was 15.82 oz., as against 6.86 oz. in the latter case. In the lot that was thinned the weight of the largest single fruit was 18.9 oz.; in the lot not thinned, the weight of the largest fruit was 15.56 oz.

Experiments were made on the effects of removing tomato fruit clusters upon the weight and quality of the fruit. Forty plants of Mikado were divided into 8 lots of 5 plants each.

> "Plat 1 was restricted to 1 fruit cluster, plat 2 to 2 fruit clusters, and so on through plat 8, which bore 8 clusters. The leaves of the plants of plat 1 became very large, fleshy, and were in the majority of cases covered with adventitious buds, which developed into branches, some of which bore fruit of inferior quality. These adventitious buds did not develop until the fruit of the one-cluster plat was well advanced toward ripeness. The fruit of plat 1 was practically worthless, but few specimens either ripening or coloring uniformly. Several cracked open, and all had an acrid or bitter taste and were hard and knotty in places. The fruit of plat 2 was considerably superior to that of plat 1 but partook to a more or less extent of its abnormal characteristics. An occasional adventitious branch appeared upon the leaves, and but few of the tomatoes were of good quality. The remainder of the plants bore excellent fruit with the exception of plats 7 and 8. These were smaller and more irregular in shape than plats 3 to 6, inclusive."

Vines bearing 4 and 6 clusters gave the largest yield; those bearing 3 or 4 clusters gave the largest average weight of individual fruits.

Tests have been made for 5 years to compare the yields of onions grown directly from seed with transplanted onions.

"The transplanted onions ripened from 2 to 19 days earlier than the others and averaged 9¼ days earlier. The average of culls was 5½ and 14 per cent in favor of transplanting. The keeping qualities of the two lots in the years 1895 and 1896 were slightly in favor of the transplanted onions."

They also yielded on an average throughout the test 18.4 per cent more than those not transplanted.

Tests of subsoiling light sandy soil are reported. Land that was subsoiled to the depth of 18 or 20 in. gave considerably larger yields of cabbage, cauliflower, tomatoes, Irish potatoes, eggplant, and corn than land not subsoiled. The difference in yields was probably exaggerated by the facts that the season was very dry and that the area upon which experiments were conducted had probably never before been plowed 4 in. deep. It is believed, nevertheless, "that larger areas of the lighter soils of the State would be greatly benefited by subsoiling once in 4 or 5 years, if the subsoil were left in its original position and not brought to the surface."

A test of level and ridge culture with cabbage gave results much in favor of the former. Tests were made of deep and shallow setting of cabbage. The plants were 4 in. high when transplanted. One lot was set with the bud just level with the surface of the soil, another no deeper than the plants grew in the flats, and a third halfway between. The plants that were set with the bud level with the surface of the soil produced the largest number and average weight of heads. A test of 30 varieties of cabbage is reported.

The root killing of nursery stock, E. S. Goff (*Florists' Exchange, 11 (1899), No. 26, p. 672*).—It is the author's opinion that in the severe freeze of last winter soil exposure or other unknown conditions were generally more potent in determining the amount of damage to fruit trees than hardiness of varieties. Trees on sod or poorly cultivated ground generally escaped injury more often than those on well-cultivated lands, though this was not always the case. The effects of the freeze give force to the fact "that in the breeding of hardy fruit trees we have 2 distinct problems in hand, i. e., to produce a hardy top and a hardy root to support it." It is suggested that seedlings grown from various kinds of crabs, like the Virginia, would be preferable for root or crown grafting to those of the common apple; and that the Virginia crab might be bred in the course of a few generations to come true enough from seed for all purposes of grafting. In like manner the sand cherry and the wild red cherry should be experimented with as stocks for the cherry, and the plum should be confined to American stocks. Among the Rubus fruits the Loudon raspberry among the reds and the Older among the blacks are mentioned as having established claims to remarkable hardiness.

Referring to the planting of nursery stock injured by freezing, it is said that "if only the fibrous roots are killed, the trees may be transplanted with as much safety as if no injury had occurred, for the fibrous roots are mostly sacrificed in transplanting by our present systems."

Notes on plum culture, C. S. CRANDALL (*Colorado Sta. Bul. 50, pp. 48, pls. 9*).—This bulletin is a general treatise on plum culture. Specifically the topics treated are as follows: Derivation and distribution of our plums, propagation of the plum, pruning, soils, irrigation, distance of planting, arrangement of varieties for cross pollination, and self-fertility of plums.

Contrary to the common practice of setting trees 15 by 15 ft., a distance of 15 by 20 ft., or even 20 by 20 ft. is recommended. The best-formed trees in the station orchard are those headed 30 to 36 in. from the ground. As a preventive against frost cracks the station has found wrapping with burlap effective and inexpensive.

Observations were made on the blossoming season of plums in Colorado, and a chart was constructed for the station orchard of 56 varieties. A comparative study was made of the blossoming seasons, as shown by this chart and the chart constructed for the latitude of Denton, Maryland, by the Vermont Station (E. S. R., 9, p. 839). The latitude of Denton is nearly the same as that of Colorado Springs, but differences in altitude and climate make a considerable difference in the season of growth.

"The two striking differences between the Maryland and Colorado tables are in the commencement of blooming, and in the length of the periods. Variations in climate would lead us to expect differences in the commencement of blooming. This difference here appears as 17 days, and it is probable that variations in seasons might either increase or diminish this. The variation in length of period is extreme. The shortest period recorded in the Maryland table is 2 days. Our shortest is 12 days.

The longest periods are 7 days in Maryland and 31 days in Colorado. The great length of the periods observed here may in part be accounted for by the weather conditions prevailing at the time. It will be observed that 11 varieties began blooming on April 30, and that 9 varieties began on May 7, none opening in the interval. This is directly attributable to a storm which prevailed between these dates."

In the study of the self-fertility of plums, 629 flower buds, representing 40 varieties, were covered with paper sacks. When the flowers had opened and the stigmas were viscid each stigma was copiously covered with pollen, either from the same flower or another flower of the same cluster. The pollen was in good condition. An examination June 6 showed 113 apparently well-formed fruits, or 17.94 per cent, and 105 imperfect fruits, or 16.69 per cent. June 23 there remained but 6 fruits, or less than 1 per cent.

Again, 699 flower buds, representing 41 varieties, were covered but not hand pollinated. June 6 there were 123 well-formed fruits or 14.73 per cent and 129 imperfect fruits, or 15.59 per cent. June 23 the number of fruits remaining was 7, or about 1 per cent. "In final results, then, there is a remarkably close agreement between the 2 sets. The natural conclusion is that the infertility did not lie in the failure of the stigmas to receive the pollen, but must be looked for either in an inherent antipathy which the plant has for its own pollen or in some outside influences." Definite conclusions can not be satisfactorily drawn because the "June drop" was very heavy from all the trees.

Popular notes are given on the powdery mildew of the plum and cherry (*Podosphæra oxyacanthæ*), black knot (*Plowrightia morbosa*), plum pockets (*Exoascus pruni*), and a blight disease, the nature of which was not well understood. Descriptive notes are given on a number of varieties.

Strawberries, S. M. EMERY (*Montana Sta. Bul. 16, pp 69–82*).—A test was made to determine the practicability of maintaining the productiveness of berry plants at a profitable point after the second year. Fifty-eight varieties were set in the spring of 1895. After fruiting in 1896 the beds were thoroughly cultivated, irrigated, and mulched in the winter. The yields of each variety for 1896 and 1897 are tabulated. With all but 5 varieties the second crop was heavier than the first, the average gain, excluding the varieties that showed a decrease, being 10⅝ lbs. to 25 plants. The very free irrigation employed did not, however, appear to have a favorable effect on the flavor of the fruit.

Ten days after the occurrence of a white frost observations were made on the extent of the damage. Varieties differed much in hardiness, the number of injured plants varying from zero in the case of Bisel, Crescent, Gen. Putnam, Princeton Chief, Parker Earle, Robinson, Stevens, Shuster Gem, and Warfield, to 12 per cent of Columbian, with an average of 4 per cent for all varieties that had suffered injury. The extent of damage did not appear to be correlated with the blossoming period.

In this connection a microscopic study was made by the station biologist, E. V. Wilcox, to determine whether there is any recognizable variation in the anatomical characters of strawberries to account for the physiological differences. Some anatomical differences were discovered, but not enough on which to base a safe conclusion. "There is not a question of doubt but that there is a vast difference in the makeup of the different varieties of strawberry blooms and fruits in respect to frost resistance."

On the influence of the removal of the runners of strawberry plants upon their fertility, U. DAMMER (*Gard. Chron., 3. ser., 25 (1899), No. 641, pp. 217, 218*).—A report on an experiment made by Mr. Duerkoptf to decide whether it is better to remove runners as often as possible or not until after fruiting. Fifty Sharpless strawberries were planted in each of 6 rows. "At the beginning of September, when the plants began to grow, the runners of all the plants were cut off. From this date, September 5, the plants of row 1 were deprived of their runners weekly, . . . those of row 2 fortnightly, . . . those of row 3 every third week, . . . and so forth, each following row being treated a week later. . . . On October 17, 1897, the experiment was interrupted, as no more new stolons or runners were formed. At the beginning of June, 1898, the first new runners appeared. On June 5, 1898, the stolons of all plants were removed. Then the plants in the single rows were cultivated in the same manner as during the previous year until June 19. During the week, from June 19 till 25, the number of leaves, fruiting stalks, and fruits of each of the 300 plants were counted." The result was as follows:

Effect of removing runners of strawberry plants.

Row	Runners removed	Number of following parts in each row June 19–25			Average number of following parts produced by each plant.			Number and per cent of ripe fruits June 21		
		Leaves	Fruiting stalks	Fruits	Leaves	Fruiting stalks	Fruits	Whole number fruits	No ripe fruits	Per cent ripe fruits.
1	Weekly	1,175	177	916	23.50	3.54	18.32	916	53	5.78
2	Fortnightly	1,137	159	841	22.74	3.18	16.82	841	59	7.01
3	Every 3 weeks	1,139	167	860	22.78	3.34	17.20	860	36	4.18
4	Every 4 weeks	1,009	127	628	20.18	2.54	12.56	628	55	8.75
5	Every 5 weeks	970	105	618	19.40	2.10	12.36	618	78	12.62
6	Every 6 weeks	928	73	482	18.56	1.46	9.64	482	54	11.20

Except as to row 3, the results show that the number of fruits is increased by removing the stolons as often as possible. The time of ripening, however, is delayed by the operation. As to row 3 the experimenter thinks that some peculiarities in the soil may have influenced the result.

The grape, R. H. PRICE and H. NESS (*Texas Sta. Bul. 48, pp. 1145–1176, figs. 8 pls. 11*).—The first part of this bulletin treats of experimental work, and comprises classification, descriptive notes on 205 varieties, and recommendations. The varietal descriptions include date of bloom in the station vineyard, condition of stamens, whether erect or re-curved, date of ripening, and average yield per vine. Considerable care is taken to give the specific race of each variety to aid in the scientific selection of sorts. "Certain racial types and certain species are being found to be best adapted to certain isothermal lines. . . . No variety with any great amount of Labrusca blood has stood our climate successfully. On the other hand, those varieties possessing Lincecumii and Bourquiniana blood have stood the climate remarkably well. Nearly all varieties with much Vinifera blood are about dead."

The classification presented is that of Munson as modified by Bailey, with a few alterations by the present authors. The following varieties have done well at the station: "As table grapes, Brilliant, Bailey, Delaware, Dracut, Duchess, Golden Gem, Gold Coin, Green Mountain, and Herbert. The following are wine grapes of much promise: America, Catawba, Herbemont, Hermann, Le Noir, and Mrs. Munson."

The second part of the bulletin treats of propagation and cultivation. Notes are given on the following diseases and insect enemies of the grape, with preventive or remedial measures: Black rot, brown rot, anthracnose, root rot, grape-leaf blight, grape-leaf folder, grape-leaf hopper, and grape berry moth.

Self-fertility of the grape, S. A. BEACH (*New York State Sta. Bul. 157, pp. 395-141, figs. 3, pls. 5*).—This bulletin is a full report to date on work already noted (E. S. R., 6, p. 46; 8. p. 601). Tests of self-fertility have now been made with 169 varieties.

A feature of the work not heretofore reported is an attempt to determine whether environment may modify self-fertility. Several varieties which had been previously tested at the station were tested again in two other localities. Some showed a little difference in the degree of self-fertility, while others gave practically identical results. Tests made in different localities showed somewhat greater differences. Varieties of similar sorts tested different seasons showed a like degree of fertility in the majority of cases. Rarely was the degree of variation marked. It is inferred from these results that variable sorts would differ in self-fertility in different parts of the same vineyard.

In regard to the author's previously published lists of self-fertile, imperfectly self-fertile, and self-sterile grapes, the question has arisen whether the variation in the degree of self-fertility in some varieties is sufficiently great to make such a classification unreliable. A comparison of the present classification and previous ones shows that while some varieties have been transferred from one list to another, in the majority of cases the results have been practically similar with the same variety in different seasons and different localities. Variations in self-fertility were in no case sufficient to be of cultural importance. "Changes from one class to a widely different one are not to be expected."

To assist in the selection of varieties for cross pollination, observations were made on the blossoming seasons of the varieties in the station vineyard. The data are tabulated for the years 1892 to 1898, inclusive. Vulpina (Riparia) is the first species to come into bloom, followed by Aestivalis and Labrusca successively, with Lincecumii and other southwestern species last.

An attempt was made to determine the causes of self-sterility in the grape. In nearly all the varieties under experiment the discharge of pollen from the anthers was observed; hence in these cases self-sterility could not be due to an insufficient supply of pollen. Self-pollination takes place in varieties having long stamens, since most of such, though not all, are self-fertile. But, as has been previously reported, all varieties having short stamens are self-sterile or nearly so. Since in this case also fruits are sometimes formed, it is concluded that self-pollination of short-stamened varieties also takes place; hence self-sterility is not due to lack of self-pollination but to self-fertilization. Three explanations are suggested for the fact of nonfertilization:

> "First, the stigma may not be receptive when the pollen is discharged and the pollen may perish before the tubes enter the stigma; or second, either the pollen or the pistils may be imperfectly developed; or third, the pollen may be incapable of fertilizing a pistil of its own variety because of a lack of affinity between the two. . . .
>
> "The evidence that self-sterility in general is due neither to defective pollen nor to defective pistils may be summarized as follows: Pollen is formed abundantly. Pollen retains its vitality till long after the pistil should become receptive. Pollen of self-sterile grapes may successfully fertilize other grapes. Pistils of self-sterile grapes are usually well developed. They develop no fruit when cross pollinated.
>
> "In view of the following considerations, the most satisfactory explanation of self-sterility which can be presented appears to be that with self-sterile grapes there is a lack of affinity between the pollen and the pistils of the same variety. Nearly all of the self-sterile list and of the list of varieties which give very imperfect self-fertilized clusters are known to be hybrids. Possibly all are hybrids. Self-sterility is often found among plant hybrids."

Referring to the reliability of the method of testing self-fertility by covering the clusters, the author states that "out of 169 cultivated varieties of the grape which have been tested here by this method, 103 produce on the average marketable clusters when the blossoms are covered." Further discussion of the pollination of the grape is reserved for a future report.

Plant individualism, L. F. KINNEY (*Proc. Soc. Prom. Agr. Sci., 1898, pp. 144-149*).—Attention is called to the importance of considering the individualism of the plant and its peculiarities as factors in gardening experiments and in teaching horticulture.

Miscellaneous analyses, G. S. JENMAN and J. B. HARRISON (*Rpt. Agl. Work Bot. Gard. [British Guiana], 1893-1895, pp. 121-127*).—Analyses are reported of fresh kola nuts, local-grown Irish potatoes, *Calathea allouya*, slippery callalu, caterpillar and Indian callalus, pumpkins, unripe ochroes, white and red Mandura beans, purple-flowered and podded Bonavis beans, *Sesbania ægyptiaca*, and the fruit of the calabash tree.

Spontaneous hybrids of hardy plants, C. W. DOD (*Gard. Chron., 3. ser., 25 (1899), Nos. 636, p. 132; 637, p. 148; 638, pp. 164, 165; 641, p. 210; 644, pp. 259, 260; 645, pp. 276, 277*).—Notes on a number of hybrids.

Reciprocal influence of stock and scion, T. J. BURRILL (*Trans. Illinois Hort. Soc. 1898, pp. 62–72*).—A review of the present conflicting opinions as to the reciprocal action of stock and scion. The article includes translations of parts of articles by L. Daniel on the creation of new varieties by graftage[1] and on the amelioration of the wild carrot by grafting it on the cultivated carrot.[2]

The flavor in fruit (*Garden, 56 (1899), No. 1444, p. 65*).—A gardener's notes on variations of flavor in a number of sorts of fruit under different conditions of culture.

Peat as a fruit preservative (*Jour. Agr. and Ind. South Australia, 2 (1899), No. 11, pp. 887, 925*).—The antiseptic properties of peat have recently been utilized by European fruit growers for the preservation of fruit. The fruit is merely buried in the peat without wrapping in paper. Apples and pears acquire no taste from it and keep for many months. One hundred pounds of fruit require about 10 lbs. of dried peat. Grapes and lemons were preserved in the same way with excellent results.

The use of chemical fertilizers in horticulture, OMNIS (*Monit. Hort., 1899, May 10, p. 108; abs. in Jour. Soc. Nat. Hort. France, 3. ser., 21 (1899), pp. 454, 455*).—It is stated that while barnyard manure must remain the fundamental fertilizer for the garden, its use is advantageously supplemented with a quick-acting and very assimilable fertilizer, according to the peculiar requirements of the particular kind of plant.

Vegetables cultivated for their leaves, as salad plants and cabbage, require especially nitrogen and phosphoric acid. In addition to the usual fertilizers, salad plants may advantageously receive 1.5 kg. of nitrate of soda and 2 kg. of superphosphate per are. For cabbage these amounts should be doubled. Vegetables cultivated for their roots do well on the same fertilizers as cabbages, to which should be added, however, 1 or 2 kg. of muriate or sulphate of potash, according to the nature of the soil. Leguminous vegetables should not receive any barnyard manure. In a well-arranged system of culture they come at the end of a rotation. They do well on mineral fertilizers, and may receive per are from 3 to 5 kg. of Thomas slag or superphosphate of lime and 2 kg. of muriate or sulphate of potash. Bulbous and tuberous vegetables may receive a supplementary dressing of 2 kg. of nitrate of soda, 3 kg. of superphosphate, and 1 kg. sulphate of potash per are.

The vegetable garden, C. H. GREATHOUSE (*U. S. Dept. Agr., Farmers' Bul. 94, pp. 24, figs. 8*).—The bulletin contains suggestions for the cultivation of the kitchen garden, and specific cultural directions for the most common vegetables.

Vegetable tests for 1898, L. R. TAFT ET AL. (*Michigan Sta. Bul. 170, pp. 251–283*).—Tests of and descriptive notes on numerous varieties of bush beans, pole beans, cabbage, cauliflower, kale, kohl-rabi, cucumbers, lettuce, onions, peas, potatoes, radishes, sweet corn, and tomatoes. Tests have been made of various materials as preventives of the scab upon potatoes. The materials used were chlorid of lime, formaldehyde gas, formalin solution, lysol solution, carbolic-acid solution, chlorin gas, and corrosive sublimate. Potatoes soaked 2 hours in ½ per cent formalin solution or ½ hour in $\frac{1}{2000}$ corrosive sublimate gave best results.

Culture of string beans, H. THEULIER fils (*Rev. Hort., 71 (1899), No. 10, pp. 240, 241; Garden, 55 (1899), No. 1438, p. 401*).—Detailed cultural directions in which the reason is given for each operation.

Culture of the ginger plant, G. LANDES (*Rev. Cult. Coloniales, 4 (1899), No. 31, pp. 357–366*).—An article treating the subject from the cultural and commercial points of view.

Etymology of the word haricot (*Jour. Soc. Nat. Hort. France, 3. ser., 21 (1899), p. 420*).—A French scholar believes that he has proven that the words haricot, tomato, cacao, and avocado, the derivation of which have been hitherto unknown, are only transliterations of the words which were used in an ancient American dialect to designate these vegetables. It is believed that this etymology furnishes a new proof of the American origin of *Phaseolus vulgaris*.

---

[1] Compt. Rend. Acad. Sci. Paris, 118 (1894), No. 18, pp. 992–995.

[2] Compt. Rend. Acad. Sci. Paris, 127 (1898), No. 2, pp. 133–135.

Autumn vs. spring-sown onions, G. MacKinlay (*Gard. Chron., 3. ser., 25 (1899), No. 633, pp. 92, 93, fig. 1*).—In the summer and early fall of the very dry season of 1898, spring-sown onions were more or less attacked by maggots and mildew, against which remedies were of little avail. The attack was worse on spring-sown onions than on those that were sown in autumn and transplanted. This is attributed to the fact that the transplanted onions had become better established.

Winter turnips, J. Rudolph (*Rev. Hort., 71 (1899), No. 14, pp. 339–341, figs. 4*).—Notes on culture and classification and descriptions of varieties.

Licorice (*Pacific Rural Press, 57 (1899), No. 24, p. 371*).—Historical and cultural notes.

Cultivation of the vanilla bean in Mexico, A. B. Jones (*U. S. Consular Rpts., 1899, No. 224, pp. 151–155*).—Cultural and commercial notes.

Vanllia (*Queensland Agr. Jour., 4 (1899), No. 6, pp. 477–483, figs. 4*).—Notes on the culture of the plant and the preparation of the pod for market. The subject of pollination is treated at some length.

Variety tests of fruits and vegetables, H. Benton (*Alabama Canebrake Sta. Rpt. 1898, pp. 4–8, 10–12*).—Reports tests of 52 varieties of watermelons and 56 varieties of cantaloupes grown from seed imported from Russia by this Department. Most of the watermelons are classed as poor and the larger part of the cantaloupes died. Of those that lived only 3 are classed as good. Notes are also given on Russian varieties of maize, pumpkins, smooth brome grass, turnip, sunflower, and cabbage. Notes are given on 25 varieties of strawberries. Lady Thompson, Hoffman, Mary, and Darling are classed as very prolific. Variety tests of tomatoes are also reported.

Nursery hints, L. C. Corbett (*West Virginia Sta. Bul. 54, pp. 143–175, figs. 33*).—Popular notes on the propagation of plants by natural processes, by cuttings, layers, grafts, and buds, together with hints on pruning.

Guide to fruit culture, A. Breden (*Leitfaden für den Obstbau. Vienna: W. Frick, 1898, pp. 78, figs. 43*).—A practical work on fruit culture based on the underlying principles.

Fruits of Ontario, L. Woolverton (*Toronto: Ontario Dept. Agr., 1898, pp. 95, figs. 160*).—Carefully prepared original descriptions and illustrations of a considerable number of varieties of apples, cherries, currants, gooseberries, grapes, pears, peaches, strawberries, and quinces cultivated in Ontario.

The experiment orchard, S. M. Emery (*Montana Sta. Bul. 16, pp. 82–89*).—Notes are given on fruit stocks for Montana. Transcendent and Virginia crabs are recommended. Trees are protected in winter by wrapping the stems from the ground to the crotches with newspapers. A list of varieties of apples, pears, crabs, cherries, apricots, plums, and prunes set in the station orchard is given showing the number set and the number still living. Currants did well at the station but gooseberries, dewberries, and blackberries were a failure.

Dwarf fruit trees, F. Boulon (*Florists' Exchange, 11 (1899), No. 25, p. 655, figs. 3*).—Dwarf fruit trees are stated to have certain advantages over high trees: "(1) A large number can be grown in very limited space; (2) the cultivation of vegetables and flowers near them can be accomplished without fear of shade; (3) they produce beautiful and excellent fruits; (4) they are an ornament to the vegetable garden; (5) they have the advantage of resisting the winds of autumn which cause the fruit of high trees to fall before maturity.

Manuring fruit trees in Holstein (*Gard. Chron., 3. ser., 25 (1899), No. 650, p. 381*).—Every other winter a few holes are dug in the ground about 4 or 5 ft. from the trunk of the tree and about 1 ft. deep, or closer and shallower in the case of small trees, and filled with liquid manure about four times during the winter months. The trees are said to produce excellent fruit in abundance without any cultivation.

Hardiness of peaches, L. C. Corbett (*Amer. Gard., 20 (1899), No. 239, p. 512*) —The author's observations have led him to the conclusion that age, exposure, and soil conditions are greater factors in determining what is called hardiness in the peach tree than varietal difference, provided they belong to the same races. It is believed that young trees and old trees are less able to stand cold than those in their prime.

Frozen trees and their treatment, L. R. TAFT (*Michigan Sta. Spec. Bul. 11, pp. 4*).—Notes on the injuries to fruit trees and grapes in Michigan during the extreme cold of last winter and suggestions for their treatment. Notes are given on spraying for leaf curl. An experiment was made to determine the best time for making the application. Trees sprayed in March showed little or no signs of the disease, while those not sprayed until the latter part of April were seriously injured.

Some effects of last winter on nurseries and orchards in Iowa, J. CRAIG (*Gardening, 7 (1899), No. 163, pp. 294, 295*).—Notes on the hardiness of the various common orchard fruits and fruit stocks in Iowa. Much of the injury is believed to be due to root killing. The conditions which cause root killing are stated to be severe freezing on bare ground unprotected by vegetation or snow. The branches may throw out leaves and bear blossoms, but after exhausting the stored food in the buds and twigs wither and die with the entire tree.

Resistance of blossoms of different varieties of peaches to frost, J. T. BOGUE (*Pacific Rural Press, 57 (1899), No. 24, p. 370*).—It is believed that varieties with small, partly closed flowers escape frosts which make the large wide-open blooms infertile. Observations are not yet conclusive.

Stone splitting in peaches (*Garden, 56 (1899), No. 1443, p. 35*).—This undesirable trait is said to be more frequently observed in some varieties than others, and is due generally to faulty cultivation. Too rapid growth of trees at the ripening period is one of the principal causes. Root pruning and applications of lime to the soil will correct the trouble to some extent.

Judging or scoring fruits, W. R. LAZENBY (*Proc. Soc. Prom. Agr. Sci., 1898, pp. 156-161*).—A discussion of the ideal qualities of the apple for commercial purposes and scale of points for judging the fruit of the apple, grape, strawberry, and tomato.

The cultivation of the olive, A. K. ROLLOV (*Tiflis, 1899, pp. 111 + 64; rev. in Selsk. Khoz. i Lyesov., 192 (1899), Mar., pp. 702, 703*).

Kakis, A. DE BOSREDON (*Prog. Agr. et Vit. (Éd. L'Est), 20 (1899), No. 18, pp. 546-550, figs. 2; 19, pp. 579-584, figs. 3; 20, pp. 610-613, figs. 2*).—A full discussion of the subject, comprising botanical and pomological descriptions, use as a decorative plant, descriptions of 22 varieties, and detailed cultural directions.

Loquats in California (*Pacific Rural Press, 57 (1899), No 24, p. 369, fig. 1*).—Notes on the work of a specialist in the improvement of this fruit. Advance is considered the best variety and notes are given on it.

Notes from the South Haven Substation, L. R. TAFT and T. T. LYON (*Michigan Sta. Bul. 169, pp. 141-250*).—Variety tests with varietal notes are reported of a large number of strawberries, red raspberries, blackberries, currants, gooseberries, grapes, apples, cherries, peaches, pears, and plums. The wineberry, Japanese mayberry, Loganberry, and strawberry-raspberry are reported on unfavorably. The last named "bids fair to become a troublesome weed and, as it has no value, its introduction should be discouraged."

Among the more productive varieties of strawberries were Acme, Arkansas Traveler, Aroma, Arrow, Auburn, Avery, Beauty, Bickle, Bouncer, Bubach No. 5, Crescent, Daisy, Fountain, Giant, Greenville, Haverland, Irene, Isabel, Knight, Lehigh, Leroy, Lincoln, Little No. 42, Longfield, Orange Co., Princeton, Shawnee, Sherman, Shyster, Smith, Stahelin, Star, Tennessee, Wood, and Woolverton.

Among the more productive of the red raspberries were Brandywine, Church, Cuthbert, Early King, Golden Queen, Hansell, Kenyon, London, Marlboro, Miller, Reeder, Thwack, and Turner.

Bush fruits for 1898, L. R. TAFT ET AL. (*Michigan Sta. Bul. 171, pp. 285-290*).—Tests and descriptive notes on a number of varieties of blackberries, raspberries, and grapes.

Strawberries for market, J. DWYER (*Amer. Gard., 20 (1899), No. 235, pp. 449, 450*).—Notes on the varieties that a commercial gardener has found most profitable for market purposes. The varieties are: Michel Early, Lovett Early, Marshall, Wm. Belt, Brandywine, Parker Earle, and Gandy. Any of these sorts can be shipped a distance of 150 miles and arrive at their destination in good condition.

Grapes, J. S. MOORE (*Mississippi Sta. Bul. 56, pp. 22*).—A popular bulletin on grape culture. A large number of varieties are described. The following varieties, given in the order of maturity, are recommended: *Shipping list.*—Champion, Ives, Perkins, Niagara, Delaware, Lindley, Concord, Hilgard, Moench. *Table or local market.*—Perkins, Niagara, Delaware, Agawam, Brighton, Lindley, Concord, Hilgard, and Moench. Sacking did well with most varieties at the station and is recommended.

The preparatory work in grapevine culture, DAL PAIZ (*Sci. Amer. Sup., 48 (1899), No. 1228, pp. 19690, 19691, figs. 10*).—An article treating of the operations preceding planting, as drainage, terracing, trenching, and methods of plowing.

Why some grapes fail to fruit, F. H. HALL and S. A. BEACH (*New York State Sta. Bul. 157, popular ed., pp. 8, figs. 2, pl. 1*).—A popular edition of Bulletin 157 (see p. 248). In this edition a large number of varieties are grouped according to their blossoming period to aid in the selection of varieties for cross pollination.

DISEASES OF PLANTS.

Report of the botanist, J. W. TOUMEY (*Arizona Sta. Rpt. 1898, pp. 160–169, figs. 2*).—Considerable attention has been paid to the date palm in southern Arizona (E. S. R., 10, p. 851). The author's conclusion is that in certain portions of southern Arizona the cultivation of the date fruit can be profitably carried on.

Some 3 years ago the author's attention was directed to an alfalfa field where the plants were dying in spots in various parts of the field. The following year the disease became so bad that the field was plowed and part of it set with nursery stock, while another portion of the field was planted in tobacco. About 7 months after the nursery stock was planted a large portion of it, without reference to variety, began to die, and the disease made such progress that it became necessary to destroy all the plants. The tobacco was uninjured. Many other fields have been similarly affected throughout southern Arizona, and, in addition to alfalfa, in some localities apples, peaches, apricots, almonds, many small fruits, and a great variety of ornamental trees and shrubs are attacked.

The cause of the disease is attributed to a common root-rot fungus (*Ozonium auricomum*). An examination of affected alfalfa fields in Salt River Valley showed that the fungus was most abundant on the lower portion of the roots and extended to within 2 or 3 in. of the surface. As the disease spreads by contact, it is recommended that a trench be dug around all regions of contagion. The recent serious injury from this disease has called for more extended investigation, which is now in progress.

Several times during the past 2 years the author's attention has been drawn to a number of fruit trees dying from no apparent cause, death occurring soon after the trees come into full foliage. The injury is indicated by the leaves turning brown and curling up, and as it progresses the leaves become dry and finally fall away. The peculiar curling tendency is quite characteristic of sunburn and is in itself sufficient to enable anyone to recognize it. The cause of the sunburn is said to be the inability of the leaves to secure sufficient water to meet the demands of rapid transpiration. All plants that have been weakened from any cause whatever are most subject to sunburn, while trees with a good root system, well fed, and having a good water supply in well-aerated soils are able to stand extremes which would kill other trees not growing under these favorable conditions. Crown knot and a lack of nitrogen, which is so apparent in many of the soils of Arizona, would also weaken trees and make them liable to sunburn.

Notes are given on the care of fruit trees, with instructions for supplying the deficiency in nitrogen, cultivation, etc.

Sour clover, crimson clover, alsike clover, burr clover, Bokharà clover, sainfoin, Japanese clover, and cowpeas were tested for green manuring, being grown under as similar conditions of soil and moisture as could be obtained. The ones coming nearest to the requirements were sour clover, crimson clover, Bokhara clover, and cowpeas. The latter, however, are not suited for winter growing. To this list should be added alfalfa, which is a most valuable forage plant and under most circumstances the best suited for green manuring purposes.

Anthracnose of beans, E. GAIN (*Extrait Compt. Rend. Assoc. Franc. Avanc. Sci. 1898, pp. 389–391*).—This disease, which is due to *Colletotrichum lindemuthianum*, is said to be quite common in the United States, England, and Germany, and to have been lately observed in France. The author reports having recognized it in at least 20 varieties of cultivated beans. In some cases he found from 5 to 18 per cent of the beans diseased. In some experiments conducted in 1897 the anthracnose reduced the yield of beans in 2 cases to only 8 and 9½ times the amount of the seed, while sound seed produced from 100 to 120 fold.

A number of investigations of the author are briefly reported upon, from which he concludes that the value of seed is greatly depreciated by the presence of the fungus. The specific weight is reduced from 3 to 5 per cent and a great many of the seeds lose the power to germinate.

Some pot experiments are briefly reviewed, in which the effect of infested soil and of diseased seed in propagating the disease are shown. Plat experiments conducted in the same line gave similar results. The author recommends that seed be carefully selected before planting, as a means of greatly reducing the disease. By following out this suggestion and spraying with Bordeaux mixture the bean anthracnose could probably be held in subjection.

Experiments on finger-and-toe (club root) of swedes (*Bd. Agr.* [*London*] *Rpt. Agr. Ed. Great Britain, 1897–98, pp. 89–93*).—A report is given of a number of experiments on the effect of soil treatment with caustic lime, copper sulphate, gas lime, bleaching powder, chalk, and basic slag for the prevention of the club root, due to *Plasmodiophora brassicæ.* The results show that the sulphate of copper and bleaching powder were of little value, while the caustic lime, chalk, and gas lime, when thoroughly mixed with the surface soil, tend to greatly prevent the disease. It also appears that the lime should be applied to the soil a considerable time before swedes or turnips are grown. Basic slag had but a slight effect in checking the disease. Where this disease is prevalent all manure produced from affected roots should be applied to parts of the farm where turnips and allied crops are not grown; and in severe cases the growing of such crops should be entirely discontinued for a number of years, gradually restoring the soil by careful dressing with some form of lime.

Phytophthora infestans as a cause of potato rot, L. HECKE (*Jour. Landw., 46 (1898), Nos. 1, pp. 71–74; 2, pp. 97–142, pls. 2*).—The author states that *Phytophthora infestans* is an indirect cause of potato rot, and while a rot of the tubers always follows an attack of this fungus, yet it can not be considered as the immediate cause. *Clostridium butyricum* is reported as parasitic on the potato.

The life history of *P. infestans* is reviewed at considerable length and the effect of dry weather on the development of the conidia is shown. The different methods of dissemination are discussed, the principal ones being insects and winds.

Experiments were conducted for the prevention of the disease, and it was found that fertilizers which increased the nitrogen content of the tubers rendered them more resistant to the rot. Fungicides were also successfully employed.

The relation between starch content of potatoes and their diseases, ECKENBRECHER (*Berlin: P. Parey, 1898, pp. 34; abs. in Ztschr. Pflanzenkrank, 9 (1899), No. 3, pp. 187, 188*).—Investigations are reported on the resistance of 11 varieties of potatoes to potato rot. It is claimed the liability to disease decreases with the increase in starch content. The greatest amount of disease, 7.7 per cent, was found in 1897 in a variety containing 17.7 per cent of starch, and the least, 0.05 per cent, in one which had a starch content of 20.6 per cent. The intervening varieties were diseased in about the proportion of the amount of starch found. The average percentage of disease observed on 2 varieties for 10 years as shown, varied from 0.03 to 8.3 per cent of the crop. No relation was found to exist between starch content and potato-scab infection.

Notes on apple and potato diseases, H. H. LAMSON (*New Hampshire Sta. Bul. 65, pp. 101–108, figs. 5*).—Brief notes are given on the blights and scab of potatoes and the brown spot and apple scab of apples and pears. The results of experiments for the prevention of these different diseases are given. Formalin proved as efficient as corrosive sublimate for the prevention of potato scab.

A number of experiments are reported in which the effects of different fertilizers on the development of the scab were tested. Phosphate, stable manure, plaster, air-slaked lime, and wood ashes seemed to favor the development of the scab to a greater or less degree, air-slaked lime, plaster, and ashes being especially liable to increase the amount of scab. For the other diseases described, spraying with Bordeaux mixture is recommended, formulas for the preparation of which are given.

Experiments in combating downy mildew of the grape with copper acetate, G. Briosi (*Atti Inst. Bot. Univ. Pavia, 2. ser., 5 (1899), pp. 145–157*).—A condensed report is given of extensive experiments conducted, at a number of places in northern Italy, in which the efficiency of copper acetate as a fungicide was tested upon several thousand vines. Five different mixtures containing copper acetate were tested, comparisons being made in many cases with a solution of sodium carbonate, borol or sodium borosulphate, and Bordeaux mixture. It is claimed that the different forms of copper acetate proved quite efficient in controlling the Peronospora and were without injurious effect to the vines. The different mixtures should be carefully employed, and the strength of solutions of none should exceed 1 per cent. Copper acetate solutions are said to be easier prepared and applied, adhere nearly as well as Bordeaux mixture, and are more efficient in preventing this disease. The borol and the sodium carbonate solutions were of little value, as shown by these experiments.

A pineapple disease, H. Tryon (*Queensland Agr. Jour., 3 (1898), No. 6, pp. 458–467, pls. 4*).—Under the name "a fruitlet-core rot of pineapple" the author describes a disease in which the individual components of the multiple fruit of the pineapple are attacked. In Queensland the variety known as Prickly Queen seems especially subject to the disease. Externally the fruit appears to ripen unevenly, and although the symmetry is preserved individual segments or groups of segments here and there remain pale green. Internally the fruit will be observed to contain well-defined dark-brown elongated markings or areas of diseased tissue. They differ greatly in shape, but owing to color and dimensions are always very conspicuous. These discolored areas are found to occur immediately opposite the pale-green surface markings already alluded to. The central axis of the fruit does not show any abnormal change. Upon separating the compound fruit it was found, at least in the earlier stages, that each of these discolored areas is confined to a single segment.

Various causes have been attributed to this disease and the author in his investigation has found the brown tissue to invariably contain the mycelium of a species of Monilia closely related to *M. candida*. The fungus, which seems to be new, is described without specific name. While this fungus may cause the rotting of the fruit, the immediate cause of the disease, the author states, is a species of mite, the fungus gaining access through the injury caused by the insect. This mite, which appears to be new, is figured and described under the name

Tarsonemus ananas. In addition to this mite other means of possible infection are mentioned, among them a fungus-eating acarid (*Tyroglyphus ananas*, n. sp.).

In the discussion of remedies the author states that the Tarsonemus mites occur throughout the entire pineapple plant, and when once infested the plant should be rooted out and burned, thus preventing the further spread from that source. In replacing these plants, or in starting a new plat, suckers should be derived exclusively from plants in which the disease has not previously been observed. As an additional precaution they should be soaked in a lime-and-sulphur wash or treated with a carbolic-acid wash for some time prior to planting.

A new disease of the pansy, R. E. SMITH (*Bot. Gaz., 27 (1899), No. 3, pp. 203, 204, fig. 1*).—This disease is said to be characterized by the appearance of dead spots on the affected leaves. At first these are small with a distinct black margin, but soon becoming larger give to the leaf an appearance very similar to that produced by the well-known violet-leaf spot (*Cercospora violæ*). The petals also become affected, dying in spots and along the edges. Many of the petals do not develop fully and the flower thus appears malformed and unsightly. Such flowers produce no seed, and in a large field where pansies were raised for seed considerable loss was experienced. The fungus, which appears to be new, is characterized as follows:

"*Colletotrichum violæ-tricoloris*, n. sp.—Parasitic on leaves and petals of cultivated pansy (*Viola tricolor*), causing pale yellowish spots upon the leaves and dead areas on the petals, together with more or less deformation of the blossoms. Spots at first orbicular and definite in outline, but later becoming confluent and irregular. Acervuli numerous, 50 to 150 μ in diameter, often confluent; stroma usually only slightly developed, but sometimes abundant and forming a sort of pycnidium closely approaching Vermicularia. Setæ mostly single or in pairs, 20 to 70 μ long, deep brown, once or twice septate, tapering gradually to a point. Basidia short, hyaline. Conidia oblong or slightly curved with blunt ends; hyaline, continuous, granular with vacuoles, averaging 20 by 5 μ."

Seeding on different soils to exterminate smut, J. F. HICKMAN (*Ohio Sta. Bul. 101, pp. 179–181*).—A cooperative experiment between the Kansas and Ohio stations is described in which the effect of soil on the propagation of smut was investigated. Smutted seed oats were exchanged between the two stations and grown on different soils. The results indicate that the common belief that changing oats to different soil will eliminate smut is not founded on fact.

Spraying cucumbers in the season of 1898, F. A. SIRRINE and F. C. STEWART (*New York State Sta. Bul. 156, pp. 376–396, pls. 5*).—In continuation of experiments previously reported (E. S. R., 9, p. 248, and 10, p. 454), the authors give an account of cooperative spraying experiments with late cucumbers which were conducted in 4 different localities on Long Island during the season of 1898. In each case an entire field was sprayed, 2 fields receiving 7 applications of Bordeaux mixture, one 8, and one 5. Owing to late planting and a general lack of fertility, the crop in one case was a failure.

The cost of spraying for each application was: At Greenlawn $3.39, Deer Park $2.76, Mattituck $3.20, and at Smithton Branch $2.43. The value of the increased yield above the cost of spraying was: At Greenlawn $73.74, Deer Park $22.51, and at Smithton Branch $37. At the market rate of $1.25 per thousand, it is shown that pickles can be profitably grown on Long Island, if spraying is practiced and the crop given the proper care. The cost of spraying as given represents the maximum cost, and in practice the authors believe this could be reduced one-half or in large fields even more. They recommend on Long Island spraying cucumbers commencing between July 15 and August 1, after which the vines should be sprayed every 8 or 10 days until frost.

Spraying apple trees, with special reference to apple-scab fungus, J. C. BLAIR (*Illinois Sta. Bul. 54, pp. 181–201, figs. 27*).—The two most important enemies of apple growing in the State are the apple-scab fungus and the codling moth. According to the statistics offered, they very greatly injure the crop, causing a depreciation of about 60 per cent in the apple crop of the State. Experiments have been conducted by the station since 1888 for controlling fruit enemies, and in 1898 experiments were inaugurated for the purpose of accurately determining what could be accomplished by thorough and systematic spraying. The trees were first sprayed with solutions of copper sulphate in varying strengths, using 1 lb. of the sulphate to from 5 to 15 gal. of water. Later applications of Bordeaux mixture were given the trees and Paris green was added to the Bordeaux mixture, three applications being given. The results of the treatment showed that it is very efficient in producing larger and better crops of apples. Comparisons were made in which lime wash was applied to the trees with little effect. The bulletin concludes with descriptions of various forms of spraying apparatus and a number of formulas for the preparation and directions for the application of fungicides and insecticides.

Spraying experiments, H. M. DUNLAP (*Trans. Illinois Hort. Soc., 1898, pp. 336–355, pls. 6*).—A report is given upon a series of experiments in which apple and pear trees were sprayed at different times. The first lot was sprayed once with copper sulphate before the buds started in the spring; the second was sprayed once with Bordeaux mixture after the blossoms had fallen; the third was sprayed twice with Bordeaux mixture, the first time just after the falling of the blossoms, the second, 10 days later; the fourth was sprayed once with copper sulphate before the swelling of the buds and once after; the fifth was sprayed once with copper sulphate before the buds started and twice with Bordeaux mixture after the blossoms fell. The effect of the different sprayings on foliage and fruit is stated. Among the deductions drawn from the experiments, the author states that it is necessary to spray whether a crop of fruit is expected or not, on account of the effect which the spraying exerts on the next year's crop; that Bordeaux mixture is effective on fruit and foliage; and that 2 applications after the blossoms fall are necessary to secure the best result. The application of copper sulphate before the buds started in the spring did not show any superior advantage in this series of experiments. The formula for the Bordeaux mixture used was 20 lbs. copper sulphate, 15 lbs. lime, and 300 gal. of water..

Notes on nematodes occurring on cultivated plants, E. HENNING (*Landtbr. Akad. Handel. Och. Tidskr., 1898, pp. 217–265*).—The author gives a general characterization of nematodes and describes in particular *Tylenchus hordei*, *T. scandens*, *T. devastatrix*, *Heterodera schachtii*, *H. radicicola*, and *Dorylaimus condamni*. For each of these species the more important host plants are given, together with notes on their geographic distribution, means of distribution, the symptoms of disease produced on different host plants, the development and life history of the nematodes, and means for their suppression. Of the nematodes occurring in the northern part of Europe he mentions *T. hordei* as having been found on barley in Sweden, Norway, and Northern Finland; on Elymus in Norway, Denmark, and Scotland; upon *Poa pratensis* and possibly also upon oats in Sweden; *T. scandens* is reported occurring in Sweden, where it is very common on wheat but is unknown in Denmark or Norway. *T. devastatrix* is known to occur in Denmark on clover, potatoes, and English rye grass; in Norway upon clover; but is not known to occur with certainty in Sweden. *H. schachtii* occurs in Denmark on beets and is especially injurious to oats. In Sweden it occurs on the same plants, but is as yet unknown in Norway, So far as the Scandinavian peninsula is concerned, *H. radicicola* is unknown and has only been reported in Denmark on species of Balsamina. The distribution of *D. condamni* is said to be unknown.

New spraying devices, B. T. GALLOWAY (*U. S. Dept. Agr., Division of Vegetable Physiology and Pathology Circ. 17, pp. 4, figs. 3*).—A description is given of a new spraying apparatus devised by the author, for use in place of the more expensive forms of apparatus where a limited amount of spraying is to be done. This consists of an ordinary hand syringe fitted with a Vermorel nozzle provided with a separate intake. A second form of apparatus described is a greenhouse nozzle for the application of water. It consists of a flattened casting which contains a narrow slit through which the water issues, and with a pressure of 30 to 40 lbs. the leaves of plants can be thoroughly washed without soaking their roots.

A review of the fungus diseases observed during 1897, G. BRIOSI (*Atti Inst. Bot. Univ. Pavia, 2. ser., 5 (1899), pp. 327–352*).—Notes are given of the occurrence of diseases of grapes, cereals, orchard fruits, garden products, forage plants, ornamentals, forest trees, etc. Among the notes on the garden products, experiments are reported with copper acetate for the prevention of downy mildew (*Phytophthora infestans*) on tomatoes. The different solutions used are said to be somewhat more efficient than copper sulphate solutions.

Bacterial rots of plants, L. BUSSARD (*Rev. Vit., 1899, No. 282, pp. 525–527*).

Yellow rust (Puccinia glumarum) on barley in Denmark, L. P. LAUVITSEN (*Landmandsblade, 31 (1898), No. 52, pp. 747–750*).

Potato diseases and their treatment, B. T. GALLOWAY (*U. S. Dept. Agr., Farmers' Bul. 91, pp. 12, figs. 4*).—Popular notes are given describing the early leaf blight, late blight or rot, brown rot, potato scab, and scald of potatoes, with suggestions for prevention. With suitable apparatus and labor at $1.50 per day, the author states that potatoes may be sprayed 6 times at $6 per acre, and considering the increased yield which follows the application of the fungicides, whether diseases are present or not, the writer feels warranted in recommending the application of the treatment.

Potato-scab experiments made in 1898, H. GARMAN (*Kentucky Sta. Bul. 81, pp. 5-11, fig. 1*).—A report is given of experiments made to test the efficiency of different strengths of solutions and time of soaking seed potatoes in corrosive sublimate and formalin for the prevention of potato scab. The results obtained show the superiority of corrosive sublimate treatment over that of formalin. The most effective treatment was that in which 4 oz. of corrosive sublimate was dissolved in 30 gal. of water and the seed tubers soaked for one hour in this solution.

All methods of treatment reduced the production somewhat, the untreated rows yielding a few more pounds of potatoes than the treated ones, but when the worthless scabby potatoes were thrown out, the advantage was decidedly in favor of the treated lots.

Bacterial diseases of potatoes, C. WEHMER (*Centbl. Bakt. u. Par., 2. Abt., 5 (1899), No. 9, pp. 308, 309*).—A reply is made to the criticism of Frank of a previous paper by the author on the bacterial diseases of potatoes.

Some diseases of the sweet potato and how to treat them, C. O. TOWNSEND (*Maryland Sta. Bul. 60, pp. 147-168, figs. 17*).—This bulletin is apparently a compilation of New Jersey Stations Bulletin 76 (E. S. R., 2, p. 416).

Fungus diseases of the apple and pear, M. B. WAITE (*Proc. Michigan Hort. Soc., 1897, pp. 184-191*).—Popular lecture on pear and apple scab, pear-leaf blight, and the bacterial blight of pear and apple, with suggestions for their prevention.

Diseases of the apple, W. J. BEAL (*Proc. Michigan Hort. Soc., 1897, pp. 174-183, figs. 4*).—A semipopular address describing apple scab, soft rot or blue mold, black rot, bitter rot or anthracnose, spot of Baldwin apples, leaf rust, powdery mildew, fly speck (*Leptothyrium pomi*), and twig blight.

A little-known mildew of the apple, A. J. GROUT (*Bul. Torrey Bot. Club, 26 (1899), No. 7, pp. 373-375, pl. 1*).—Notes are given on *Sphærotheca mali*. This mildew is thought to occur abundantly, but as the perithecia are borne upon the young shoots and do not mature until late in the autumn it is usually overlooked.

Canker on apple trees (*Jour. Bd. Agr. [London], 6 (1899), No. 1, pp. 66-69*).—Popularly describes diseases due to *Nectria ditissima* and *Bacillus amylovorus*, both of which are said to be commonly confused in England under the name of canker.

Can leaf curl of the peach be controlled? A. D. SELBY (*Proc. Columbus Hort. Soc., 13 (1898), pp. 84-88, pls. 2*).—Notes are given of experiments on the control of leaf curl (*Exoascus deformans*) of the peach. The author states that it can be controlled and a fair crop of peaches saved by the proper use of Bordeaux mixture.

Report on black rot in 1898, A. PRUNET (*Prog. Agr. et Vit. (Éd. L'Est), 30 (1899), Nos. 28, pp. 45-50; 29, pp. 75-80*).—This is essentially the same article as that given in *Bul. [Min. Agr. France] 18 (1899), No. 2, pp. 265-286*.

Parasites of the grape, F. NOACK (*Bol. Inst. Agr. São Paulo, 10 (1899), No. 2, pp. 91-114, pls. 2*).—Notes are given descriptive of mildew, anthracnose, powdery mildew, bitter rot due to *Melanconium fulgineum*, a root rot, and sooty mold or "fumagine" due to *Apiosporium brasiliense*, n. sp. The drying of the foliage by the wind is also mentioned.

Cryptogamic parasites of the grape, J. DE CAMPOS NOVAES (*Bol. Inst. Agr. São Paulo, 10 (1899), No. 2, pp. 51-90*).—Notes are given on the attacks of *Plasmopara vitis*, *Cercospora vitis*, *Oidium tuckeri*, *Glæosporium ampelophagum*, black rot, Botrytis, bitter rot, and *Saccharomyces ellipsoideus* on ripe grapes.

Some enemies of the vine (*Rev. Agr. Cien. Apl., Paraguay, 1 (1898), No. 6-7, pp. 289-299*).—Notes are given on *Margarodes vitium* and grape anthracnose, together with directions for their prevention.

A new micromycete of the grape, L. MONTEMARTINI (*Atti Inst. Bot. Univ. Pavia, 2. ser., 5 (1899), pp. 69-73, pl. 1*).—The author describes, under the name *Aureobasidium vitis album*, a new variety of micromycete which attacks the petioles and leaf blades of the grape, causing the latter to dry up and roll in. The fungus is characterized as follows: Pustules at length confluent, white; basidia hyaline, 6 to 7 μ broad and 13 to 22 μ long; spores cylindrical, 6 to 8 μ long and 1.5 to 2 μ broad.

A new disease of coffee, M. S. BERTONI (*Rev. Agr. Cien. Apl., Paraguay, 1 (1898), No. 1-5, pp. 211-223, figs. 5*).—A review is given of a number of the fungus and other diseases of the coffee plant and a new one described. This disease, which attacks the roots of the plant, is said to be quite destructive. It is due to *Rhizoctonia subepigea*, n. sp., and the parasite is described at length. Humidity of soil favors the disease. When severely attacked the author advises rooting out and destroying the diseased plants as the only preventive.

The strawberry-leaf blight, P. PASSY (*Rev. Hort., 71 (1899), No. 12, pp. 282-284, figs. 6*).—Notes are given on *Sphærella fragariæ*, with suggestions for prevention.

A method of avoiding lettuce rot, H. GARMAN (*Kentucky Sta. Bul. 81, pp. 1-4, pls. 2*).—The disease of lettuce known as rot, which is particularly severe on this crop when grown under glass, may be checked or entirely avoided, according to the author, by preventing the portions of plants above ground from becoming wet. This may be done by subirrigation or any other way so that the moisture be kept off the leaves. In order to keep the tips of the leaves from coming in contact with the wet soil, the author has found that a mulch of excelsior is very beneficial.

The aster disease, A. F. WOODS (*Gardening, 7 (1899), No. 162, p. 277*).—Notes are given of a disease of Chinese asters which is thought to be undoubtedly due to a species of Fusarium. Diseased plants should be destroyed whenever found and the soil surrounding the roots be thrown out. Asters should not be planted in soil where the disease is known to have previously existed.

A new disease of Azalea indica, P. VOGLINO (*Malpighia, 13 (1899), pp. 73-86, pls. 2*).

Diseased Hemerocallis leaves, W. G. SMITH (*Gard. Chron., 3. ser., 25 (1899), No. 652, p. 415*).—Notes the occurrence of a species of Asteroma on leaves of Hemerocallis.

A new violet disease, A. N. BERLESE (*Riv. Patol. Veg., 7 (1898), No. 5-8, pp. 167-172, pl. 1*).—Under the name *Cladochytrium violæ* the author describes a new species of fungus which is said to attack the roots of *Viola tricolor*, destroying the plant. As each dead plant is a center of infection, all such should be dug out and destroyed. If the attack becomes especially severe, violet growing may have to be abandoned for a time. Further investigations on this disease are in progress.

A violet disease (*Jour. Soc. Nat. Hort. France, 3. ser., 31 (1899), pp. 422, 423*).—The ocurrence of a severe outbreak of a disease of violets, due to *Phyllosticta violæ*, is mentioned. So severe was the attack that all leaves were destroyed in 15 days. Experiments were made which seemed to indicate that the disease could be controlled by copper fungicides.

Bacteriosis of the walnut (*Pacific Rural Press, 57 (1899), No. 25, p. 387*).—A note is given of the very destructive effect of this disease on the walnut crop. The disease may be recognized by black sunken areas in the outer hull of the fruit. All diseased material should be destroyed, the trees carefully pruned, and sprayed with Bordeaux mixture. Winter applications to young trees are thought advisable. By this method N. B. Pierce, a special agent of the U. S. Department of Agriculture, has demonstrated that more than half the loss may be saved.

A new mildew on Caragana arborescens, P. MAGNUS (*Ber. Deut. Bot. Gesell., 17 (1899), No. 4, pp. 145-151, pl. 1*).—*Microsphæra caraganæ* is figured and described.

Notes on Peridermium plowrighti, C. B. PLOWRIGHT (*Gard. Chron., 3. ser., 25 (1899), No. 652, p. 415*).—Attention is called to specimens of *Peridermium plowrighti* produced by artificial inoculations. In one case teleutospores of *Coleosporium tussilaginis* were placed upon *Pinus sylvestris* in October, and in April the Peridermium was abundant. In another series of experiments young plants of *Tussilago farfara* infected with Peridermium æcidiospores in April produced uredospores in May.

A fungus disease of Douglas fir, G. LEVEN (*Trans. Roy. Scottish Arbor. Soc., 15 (1898), pt. 3, pp. 319, 320*).—Notes the occurrence of *Phoma pithya* on the Douglas fir in Scotland, where this tree was thought to be free from disease. Fully 10 per cent of the plantings for 3 years are reported as having been destroyed by the disease.

Pathological conditions of plants due to animals, DE STEFANI (*Agr. Calabro Siculo, 23 (1898), Nos. 15, 19, 21-23; abs. in Bot. Centbl., 79 (1899), No. 2, pp. 68, 69*).—Describes a number of galls, swellings, etc., due to various insects.

Nematodes of coffee roots, A. ZIMMERMANN (*Meded. S'Lands Plantentuin, 1898, No. 27, pp. 64, figs. 17; abs. in Centbl. Bakt. u. Par., 2. Abt., 5 (1899), No. 11, pp. 415-419*).

A study of the alterations in the roots of the grape due to phylloxera, A. MILLARDET (*Extr. Actes Soc. Linn. Bordeaux, 53 (1898), pp. 29, pls. 5*).—The author recognizes two forms of injury to all grape roots except those of *Vitis rotundifolia*, viz, nodosities and tubercles. The former are produced at the extremities of very young roots and root hairs, while the tubercles may be formed on any portion of the root where longitudinal growth has ceased. The effect of each on the structure of the root is shown and the ultimate injury discussed.

Investigations on the cause of "beet sickness" with special reference to the carbon bisulphid treatment, A. KOCH (*Untersuchungen über die Ursachen der Rebenmudigkeit mit besonderer Berücksichtigung der Schwefelkohlenstoffbehandlung. Arb. Deut. Landw. Gesell., 1899, No. 40, pp. 44, pls. 5*).

Spraying will save the pickle crop, F. H. HALL (*New York State Sta. Bul. 156, popular ed., pp. 8, pls. 2*).—This is a popular edition of Bulletin 156 of the station (see p. 257).

Suggestions as to spraying, J. A. TILLINGHAST and G. E. ADAMS (*Rhode Island Sta. Bul. 52, pp. 48*).—The authors have brought together in convenient form the information necessary for the practical use of fungicides and insecticides for preventing attacks of the more common insects and plant diseases infesting orchard, garden, and other crops. Formulas for the preparation of the fungicides and insecticides recommended for use are given, and descriptions of the different forms of apparatus complete the bulletin.

The spraying of plants, W. M. MUNSON (*Maine Sta. Bul. 52, pp. 8*).—Gives a brief account of the reasons for spraying, together with directions for preparing Bordeaux mixture, potassium sulphid, Paris green, kerosene, and tobacco, and advice concerning the choice of pump, hose, and nozzle.

Spraying of fruit trees (*Jour. Bd. Agr. [London], 6 (1899), No. 1, pp. 1-5*).—Popular notes are given showing the advantages of spraying for the prevention of fungi and insects, and formulas for a number of fungicides and insecticides.

A copper fungicide designed especially to combat black rot, J. PERRAUD (*Compt. Rend. Acad. Sci. Paris, 127 (1898), No. 23, pp. 978-980*).—A fungicide composed of copper sulphate, sodium carbonate, and resin is described. The formula for preparation is given and its efficiency and adhesiveness compared with alkaline Bordeaux mixture, and a mixture of copper sulphate and soap. It is claimed that the resin mixture as recommended is much more adhesive and that it carries a larger proportion of soluble copper than either of the other fungicides. The total copper content is also larger.

Influence of Bordeaux mixture on fruit development, E. PYNAERT (*Bul. Arbor. et Flor., 1899, pp. 81-83*).

The addition of common salt to Bordeaux mixture, L. DEGRULLY (*Prog. Agr. et Vit. (Éd. L'Est), 20 (1899), No. 24, pp. 710-712*).—In a previous number of this journal the author recommended the addition of a small quantity of common salt to Bordeaux mixture when employed for the prevention of black rot of grapes. This recommendation was based upon a series of observations in which the saline solutions seemed to have given the best results. In the present note the experience of a correspondent is given from which it is advised to add not more than 250 gm. per hectoliter of solution, dependent upon the amount of copper and lime used.

Apparatus for the application of powders to plants, P. FERROUILLAT (*Prog. Agr. et Vit. (Éd. L'Est), 20 (1899), No. 29, pp. 69-75, figs. 5*).—Describes a number of kinds of improved apparatus for applying powdered fungicides to plants and compares their efficiency.

ENTOMOLOGY.

Insect pests of domesticated animals, R. S. MACDOUGALL (*Trans. Highland and Agr. Soc. Scotland, 5. ser., 11 (1899), pp. 162-204, figs. 21*).—The author gives a general classification of the insects which are injurious to domestic animals, including the common Mallophaga, Pediculidæ, Diptera, and Pulicidæ. Of the Mallophaga, the writer gives descriptions and economic notes on the following genera: Trichodectes, Ornithobius, Lipeurus, Goniodes, Goniocotes, Docophorus, and *Menopon pallidum.* Of the Pediculidæ, notes and descriptions are given of Phthirius, Pediculus, and Hæmatopinus.

As remedies for both these orders, the author suggests the use of an ointment to be rubbed into the hair for the purpose of suffocating the pests, which is to be made of 1 part of sulphur to 4 parts of lard. Several washes are also suggested: (1) A decoction of 1 oz. of stavesacre seed to a quart of liquid, half water, half vinegar. (2) Benzin 1 part, soap 6 parts, water 15 to 20 parts. Kerosene emulsion and tobacco decoction are also recommended as washes.

Descriptions and economic notes are given of the human flea, dog flea, and bird flea. The more common methods of controlling these pests are described and recommended, and it is stated that a Southern Mexican plant, *Asclepias curassivica,* which the Indians make into brooms, is effective as a repellent for fleas.

Among the Diptera, the author chooses for consideration the ox gadfly, gnats, botflies, ox warble fly, horse botfly, sheep botfly, house fly, bluebottles, flesh flies, and *Melophagus ovinus.* Notes by way of description and on the life history and economic importance of these insects are of considerable length in each case, and the most approved remedies are recommended.

Injurious insects and fungi (*Jour. Bd. Agr.* [*London*], *6 (1899), No. 1, pp. 56-69, figs. 5*).—The larvæ of crane flies (Tipulidæ) are reported as having caused considerable injury to wheat, winter oats, winter barley, and strawberry plants. Notes are given on the habits and life history of these insects.

The Scotch fir trees (*Pinus silvestris*) were attacked by *Oscinis maura.* The insect is described in its various stages, and among other remedies it is suggested that infested shoots be cut off, especially on the young trees where it is more convenient, and that larger trees be sprayed with solutions of soft soap and quassia chips.

The raspberry moth (*Lampronia rubiella*) is said to have been exceedingly injurious to raspberries, the young larvæ living in the buds and preventing their development. The insect is described and figured in its various stages. The caterpillars pass the winter in the earth and rubbish near the raspberry cane. The author, therefore, recommends that the ground be thoroughly stirred up about the canes so as to destroy the pupæ in the spring, or that soot and lime or kainit be dug into the ground so as to destroy the insects. Tomtits are reported as feeding upon the insects to a considerable extent.

The raspberry weevil (*Otiorhynchus picipes*) in its larval condition causes much injury to hop stocks and the roots of various plants, such as strawberries, gooseberries, and vines. The beetles are also injurious to wall-fruit trees, the injury being done by gnawing the bark off the shoots. The author recommends as a preventive remedy frequent hoeing of the ground about the raspberry plants.

The fruit-tree beetle (*Scolytus rugulosus*) is reported as increasing in numbers. The author mentions the symptoms by which it may be recognized that a tree is infested with these insects. It is recommended that badly infested trees be cut down and burned during the winter.

Destructive insects of North Dakota, C. B. WALDRON (*North Dakota Sta. Bul. 31, pp. 293–301*).—The author gives brief popular notes on the grain aphis, the wheat-stem maggot (*Meromyza americana*), and the Hessian fly (*Cecidomyia destructor*). He recommends the burning of the stubble or deep plowing of the land as a destruction of the flaxseeds of the Hessian fly. The frit-fly is mentioned as a near ally of the Hessian fly and as liable to be mistaken for it. The author describes the habits and appearances of the Rocky Mountain locusts, and recommends the farmer to plow deeply all lands which are suitable to serve as egg-laying ground for the locust. The young are not able to escape from the soil when the eggs hatch if they are plowed under to a depth of 5 in. Another remedy is suggested which has proved successful in many places and which consists in scattering straw over ground infested by the Rocky Mountain locust in the spring when the young are unable to fly. The young congregate under this straw in the evening and may be readily destroyed in that situation by burning. The method of plowing furrows along the side of the field, and spraying the edge of the field with Paris green, and of scattering poison bran in such situations are mentioned as effective remedies. The "hopperdozer" also is described, along with recommendations as to the best way of operating it.

The common red mite parasite and a tachina fly are mentioned among the enemies of the locust. Brief notes are given on a number of plant lice and scale lice.

Proceedings of the Entomological Society of Washington (*Proc. Ent. Soc. Washington, 4 (1899), No. 3, pp. 177–345*).—This number contains notes on a great variety of insects, myriapods, and arachnids, together with the descriptions of new species. A few papers of special interest to workers in economic entomology can be noted.

A dipterous parasite of Lachnosterna, L. O. Howard (pp. 198, 199).—Contains an account of the finding of two May beetles with dipterous eggs fastened upon them.

Some structural points in sawfly larvæ, H. G. Dyar (pp. 218–221).—The larvæ of 8 species of sawflies are described with special reference to their identification.

Classification of the old family Chalcididæ, W. H. Ashmead (pp. 242–249).—The paper contains an analytical table for the classification of the families and subfamilies belonging to this group.

An investigation of applied entomology in the Old World, C. L. Marlatt (pp. 265–291).—The author gives an account of a recent trip in the Old World and of entomological observations made en route. The means of combating injurious insects which are in common use in the Old World are discussed and an explanation is suggested for the fact that insect outbreaks are of less importance in the Old World than in the New. A number of European species of injurious insects are mentioned which are perhaps liable to be imported into this country in the future unless precautions are taken.

Descriptions of the larvæ of fifty North American Noctuidæ, H. G. Dyar (pp. 315–332).—Technical descriptions of species belonging to a number of genera, with an analytical table designed for use in identifying them.

Alfalfa, grasshoppers, bees—their relationship, S. J. HUNTER (*Contrib. Ent. Lab. Univ. Kansas, 1899, No. 65, pp. 152, figs. 59, pls. 12*).—The first part of this bulletin contains a general account of the grasshoppers which are injurious to crops in the State of Kansas. The species which are mentioned as being of especial economic importance are: *Melanoplus differentialis*, *M. atlanis*, *M. bivittatus*, *M. femur-rubrum*, *M. packardi*, *M. spretus*, *Dissosteira longipennis*, and *D. carolina*.

M. differentialis is chosen as the subject of a special study. A detailed account is given of the appearance of its different immature and mature stages, including the egg stage. Its habits of egg laying are recorded, the common food plants of the insect are listed, and an account is given of the natural enemies of this grasshopper. Among the vertebrate enemies are domestic fowls, blackbirds, meadow larks, red-headed woodpecker, catbird, red eyed virio, yellow-billed cuckoo, and the loggerhead shrike. Blacksnakes are also said occasionally to feed upon this insect. Its invertebrate enemies include the locust mite (*Trombidium locustarum*), predaceous beetles, and parasitic flies, among which are mentioned *Sarcophaga cimbicis* and *S. hunteri*. One of the Asilid flies (*Erax cinerascens*) was observed preying upon the young grasshoppers. The locust fungus (*Empusa grilli*) is recorded as being an efficient help in the control of these grasshoppers.

A detailed account is given of the internal and external anatomy of the species. The remedies which are usually recommended for grasshoppers are described and urged upon the farmers for use, including the hopperdozer, spraying with Paris green, and deep plowing of stubble fields, together with the disking of alfalfa fields in the early spring.

A bibliography of articles relating to *M. differentialis* is appended to this discussion.

The second part of the bulletin contains an account of the relationship of bees to alfalfa and various suggestions for the practical and economic rearing of bees. The experiments which were made for that purpose showed that the seed crop of alfalfa upon which bees gathered honey was 66⅔ per cent greater than that from crops of alfalfa which were not visited by the honeybee.

An account is given of the different varieties of bees, of the different forms of bees found in a single colony, and of the various products which are produced by bees. Analyses are tabulated of various kinds of honey made from different plants, and alfalfa honey is pronounced as the one which most nearly approached the standard of excellence.

The author describes the method of fertilization of alfalfa by the honeybee, and reports communications from a large number of correspondents concerning the benefits derived from the keeping of bees in connection with the raising of alfalfa. On pages 102–141 A. H. Duff gives practical directions for the rearing and the management of bees, with advice as to the kinds of hives to be preferred and as to the extraction of honey, the rearing of queens, and the winter care of bees. A brief account is given of the foul brood of bees and of the wax moth, with a suggestion of the usual remedies. A list of the principal honey and pollen producing plants of the State is appended to the bulletin.

The grain aphis; an army cutworm, E. V. WILCOX (*Montana Sta. Bul. 17, pp. 18, figs. 2*).—The grain aphis (*Siphonophora avenæ*) is reported as having caused considerable damage to grain crops in the State during the past year, the aphis being so abundant in some instances as to interfere with the successful operation of binders.

Some observations were made on the natural history of the grain aphis with results which may be stated as follows: "In the early spring the viviparous females which have wintered over on the roots of winter wheat come up on the leaves. Here, and later upon the wheat heads, an indefinite number of generations are passed until the wheat is cut. Then the aphis migrates to oats, clover, various grasses and volunteer oats and wheat, and finally to winter wheat upon which it preferably passes the winter." A cold rainy spring is mentioned as being unfavorable to the rapid multiplication of the aphis.

A number of natural enemies were noticed preying upon the aphis, among them being the ladybugs, syrphus flies, and aphis-lions. Ladybugs were observed to go down upon the roots of grain in the fall in search of the aphis, and to pass the winter in that situation along with the aphis.

Spraying with kerosene emulsion or tobacco water is mentioned as a possible remedy, and it is also recommended that the stubble should be burned soon after the harvesting of the crop; and attention is called to the advisability of rotation.

A species of cutworm (*Chorizagrotis agrestis*) was observed as occurring in unusually large numbers and adopting the army worm habit. It was seen feeding upon a large variety of food plants, including garden vegetables, fruit trees, and especially grain crops.

The remedy which was tried with best results was the running of irrigation ditches between the crop and the advancing army of worms and keeping a stream of water flowing through these ditches. The worms fall into the ditches and are drowned. Another remedy which was tried was the use of poison bait. Clover dipped in a strong solution of Paris green was used as the bait, and destroyed the cutworms very effectively. The natural enemies which were noticed preying upon the cutworms were species of ground beetles (Harpalus and Calosoma) as well as of the whirligig beetles (Gyrinus and Dyneutes). The blackbird, robin, crow, meadow lark, and domestic poultry were observed eating the cutworms.

The San José scale problem in Ohio in 1898, F. M. WEBSTER (*Ohio Sta. Bul. 103, pp. 185–199, figs. 4*).—Among the remedies to be used in controlling the San José scale the author considers 5. The first remedy, or burning, is to be adopted in case of badly infested trees, especially if these trees are young or of little value. The second remedy, or the use of whale-oil soap, in the experience of the writer is very effective. The whale-oil soap is said to injure the fruit buds of the peach if applied during the fall and winter, but when applied in the spring no decided injury was noticed, and the San José scale was thoroughly destroyed and at the same time the peach-leaf curl seemed to be checked. The whale-oil soap had no detrimental effects on fruit buds when applied in the proportion of 2 lbs. to 1 gal. of water, provided the application was made in the spring when the buds were just putting forth. The treatment by this method is said to have increased the fruit yield about 75 per cent and to have increased the growth of the trees and the amount of foliage to a considerable extent. Whale-oil soap does not destroy all of the San José scale, but the results from its use are very encouraging.

The third remedy, or kerosene, was experimented with to some extent, and the results were generally unfavorable. Kerosene, when sprayed on a dark day or in the evening, was almost uniformly harmful, injuring both the bark and the buds. All trees that were sprayed dropped their foliage prematurely. A maple tree, which was sprayed, died; 3 peach trees died from the effects of the spraying; and even apple trees were considerably injured, and one died.

The fourth remedy is applicable more especially to nursery stock, and is the method of fumigation with hydrocyanic-acid gas. This method is recommended for all nurserymen as being much more reliable than the personal examination of an entomologist.

In the line of the fifth form of treatment, or the utilization of natural enemies, the author attempted the importation of the Florida fungus enemy (*Sphærostilbe coccophila*) without much success. It is suggested that perhaps a careful examination of the conditions under which the San José scale lives in Japan would disclose some natural enemies of the scale which might profitably be imported to this country. The author believes that Japan is the home of the San José scale.

The fruit-tree bark-beetle, the common apple-tree and peach-tree borers, J. M. STEDMAN (*Missouri Sta. Bul. 11, pp. 19, figs. 7*).—The fruit tree bark-beetle (*Scolytus rugulosus*) is recorded as attacking vigorous trees as well as those which have become devitalized through other agencies. The ordinary food plants of the beetle are said to be the plum, cherry, apricot, nectarine, peach, pear, apple, and quince. Apple trees are so often weakened by the attacks of the woolly aphis that they are thus made much more susceptible to the attacks of the fruit-tree bark-beetle, and peach trees suffering from the work of the peach-tree borer are thus brought into condition to be ruined by the attacks of the bark beetle. The beetle is described and figured in its various stages. The beetles emerge the last of March in this State, and begin making their tunnels. About 80 eggs are laid by each female. The tunnels are almost entirely confined to the cambium layer. In Missouri the beetle has 3 or 4 broods during the season, each brood requiring about 5 weeks for its development. The most common parasite which preys upon this beetle is said to be *Chiropachys colon*. The best prevention from the attacks of the beetle is to keep the trees in a good, vigorous condition. Mechanical barriers are of little value in keeping off the insect. The author has used a wash made by dissolving 1 lb. of potash whale-oil soap in 2 gal. of water, which was applied about the middle of March and again about April 1 with good results. The best wash, however, in the author's experience, is made as follows: "Dissolve as much common washing soda as possible in 6 gal. of soft water, then dissolve 1 gal. of ordinary soft soap in the above and add 1 pt. of crude carbolic acid and mix thoroughly; 2 lbs. of lime is then slaked in 2 gal. of water and filtered so as to remove all dirt and small lumps; this is now added to the above and mixed, while to all is added ½ lb. of Paris green or ¼ lb. of white arsenic, and all thoroughly mixed together." This wash is to be applied to the trees by means of a spray pump as soon as the beetles emerge in the spring, and other applications may be made as required.

The second part of the bulletin contains descriptions and economic and biological notes upon the peach tree borer (*Sannina exitiosa*), the round-headed apple-tree borer (*Saperda candida*), and the flat-headed apple-tree borer (*Chrysobothris femorata*). As remedies for these borers, the author suggests digging out the grubs with a sharp knife, pouring hot water or kerosene into the burrows, and the use of thin wooden wrappers about the base of the trunks. Besides these mechan-

.ical measures certain washes are recommended, the best of which, in the author's experience, is made in the same way as the one recommended for use against the fruit-tree bark-beetle.

The forest tent caterpillar, C. M. WEED (*New Hampshire Sta. Bul. 64, pp. 75-98, figs. 14*).—The author reports an unusual amount of damage from this insect during the past year, not only to forest and shade trees, but also to fruit trees. A popular account is given of the appearance of the different stages of the insect and of its habits and life history. W. F. Fisk observed that if the young caterpillars were suddenly disturbed while feeding they fell to the ground without spinning threads. This suggested a remedy in the way of banding. Since a large proportion of the caterpillars during their younger stages fall to the ground at some time or other they can be prevented, by the use of tarred bands, from ascending the tree again. The insect is compared with the American tent caterpillar, and various differences in appearance and habit are mentioned which render more easy its identification. A list of food plants is given, which includes the plants previously published as being fed upon by this insect, and also a list of the food plants of the tent caterpillar as observed by Miss Soule in Vermont. The same observer reports a considerable list of plants in the leaves of which she found the cocoons of this insect.

The author reports that the sugar maple has been very seriously damaged by the forest tent caterpillar, and that the sugar makers have observed a different flavor in the sugar made from trees which had been defoliated the year before.

As enemies of the tent caterpillar are mentioned toads and, on the authority of Miss Soule robbins, orioles, chipping sparrows, catbirds, cuckoos, vireos, cedar birds, and nuthatches. The enemies just mentioned feed upon the caterpillars. Chickadees feed upon the cocoons, and a number of birds, including the English sparrow, feed upon the moths.

A disease which seemed to be bacterial in origin is said to have destroyed large numbers of the caterpillars. As artificial remedies the author suggests the gathering and destruction of the egg masses, swabbing the mass of young larvæ when collected together with cotton waste or other substance, spraying the trees with arsenate of lead, killing the older caterpillars when they collect upon the trunk before molting, banding the trees with raupenleim to prevent the caterpillars which have fallen off from climbing up, collecting the cocoons, and the use of lantern traps.

Combating the striped beetle on cucumbers, F. A. SIRRINE (*New York State Sta. Bul. 158, pp. 32, pls. 2*).—The observations published in this bulletin were made largely in the pickle-growing sections of Long Island. Among the food plants of the beetle are mentioned, besides the common ones, golden-rod, sunflowers, apples, chokeberries, and wild cranesbill.

The beetle issues from its winter quarters between the middle of April and the first of June. During the first few days after emerging from the ground both males and females feed actively. Egg laying begins about July 20, and extends over a period of about a month. Eggs are dropped upon the ground or upon the surface of the leaves, and usually roll from the leaves to the ground. The larvæ require for their complete development about a month, but some few seem to require nearly 2 months. The author suggests that the difference in the length of the larval period is dependent upon the food supply. The larvæ were found in the stems of cucumbers and squash, but most abundantly upon the rind of the muskmelon and of the squash and ripe cucumbers where these came in contact with the surface of the ground. The insect passes the winter in the adult stage. A description is given of the egg, larva, and pupa.

Among the parasites of this insect are recorded a tachinid fly (*Celatoria diabroticæ*) and an unidentified nematode worm.

The spraying of cucumber and melon vines with Paris green and water showed that very few beetles were killed by this method, and that the vines suffered too much damage to permit the method to be generally recommended. As trap crops the author recommends beans and squashes to be planted about the edge of the cucumber or melon patches. The beans and squashes may then be dusted with green arsenite preferably or Paris green. The use of Bordeaux mixture, in the proportion of 4 lbs. copper sulphate and 4 lbs. of lime to 44 gal. of water, as a spray upon cucumbers and melons, gives a very efficient repellent for the striped beetle. The Bordeaux mixture was found not to injure the plants to any extent. The cost of three applications did not exceed $2 per acre. Bordeaux mixture was found to be superior as a repellent to air-slaked lime or any of the bad-smelling mixtures which have been recommended for this purpose.

Wire plate covers have been used for the purpose of protecting the young squashes, but these are only serviceable for a few days while the squashes are first starting from the ground. The covers cost 2 cts. apiece or about $10 per acre for the first year.

The author's general conclusions concerning remedies may, perhaps, best be given in his own words:

> "I recommend the use of squashes as a lure and as a poisoned bait, combined with the use of Bordeaux mixture on the cucumber vines and in some cases also combined with the use of covers. I also recommend the planting of squashes or beans in September for the purpose of poisoning as many of the beetles as possible during the fall. Green arsenite and Paris green can be and frequently are used with water for poisoning the squashes and beans, but as the object of the latter is to kill as many of the beetles in as short a time as possible, it is better to use the arsenites dry for the simple reason that they can be applied stronger and not kill the vines as quickly as when used with water."

Inspection and care of nursery stock, W. E. BRITTON (*Connecticut State Sta. Bul. 129, pp. 10*).—The author calls the attention of nurserymen to the necessity of familiarizing themselves with the appearance of the San José scale, and of watching closely in order to avoid importing the scale from other nurseries to their own. Orchardists are urged to dip trees in a solution of whale-oil soap while still bunched at the time of their receipt, and to inspect their orchards carefully at not too great intervals so as to prevent the spread of San José scale.

Three common treatments for San José scale are named and described: Fumigating with hydrocyanic-acid gas, spraying with kerosene and water, and spraying or dipping the trees in a solution of whale-oil soap.

A brief account is added of the appearance of the San José scale and of its effects upon the trees which it infests.

Apiculture (*Queensland Agr. Jour., 4 (1899), No. 5, pp. 365–374*).—Gives hints on the management of bees so as to get profitable returns, and a description of a swarm catcher.

Italian bees, C. DADANT (*Rev. Internat. Apicult., 21 (1899), No. 6, pp. 102, 103*).—The author enumerates the strong points of Italian bees.

Considerations upon the colonial bees, K. SAJO (*Prometheus, 10 (1899), Nos. 486, pp. 280–284; 487, pp. 289–293; 488, pp. 312–316; 489, pp. 321–324*).—In this article the author discusses the relationship of the different members of bee colonies with one another, with the addition of general notes upon the intelligence involved in their various biological activities.

A plea for comb honey, A. GALE (*Agr. Gaz. New South Wales, 10 (1899), No. 5, pp. 406–409, pl. 1*).—Directions as to the time for putting on supers in order to get the best comb honey.

Homemade comb foundation, A. GETAZ (*Amer. Bee Jour., 39 (1899), No. 26, p. 402, figs. 3*).—A description of the necessary apparatus and method of making the comb.

Dead brood, king birds, honeydew, A. J. COOK (*Amer. Bee Jour., 39 (1899), No. 29, pp. 550, 551*).—Dead brood is distinguished from foul brood. King birds were observed eating robber flies near the beehives, but not eating the bees. Popular notes are given on the origin of honeydew.

The effect of temperatures upon the eggs, larvæ, and pupæ of bees, N. KULAGIN (*Illus. Ztschr. Ent., 4 (1899), No. 13, pp. 193–195*).—Adult bees are less affected by cold than the eggs, larvæ, or pupæ.

Poisoning by honey (*Rev. Internat. Apicult., 21 (1899), No. 6, pp. 117, 118*).—Gives a brief historical account of the subject. *Azalea pontica*, *Andromeda japonica*, *Kalmia angustifolia*, *Rhododendron ferrugineum*, and *R. hirsutum* are referred to as plants from which bees may gather poisonous honey.

The color of flowers and its influence on bee life, A. GALE (*Rpt. Australian Assoc. Adv. Sci., 7 (1898), pp. 937–945*).—From observations made by the author, the conclusion is drawn that bees in Australia show a preference for white and yellow flowers.

Classification of the bees of the superfamily Apoidea, W. H. ASHMEAD (*Trans. Amer. Ent. Soc., 26 (1899), No. 1, pp. 49–100*).—The superfamily is divided into 11 families. Analytical tables are given for identifying these families and also for identifying the genera of each family.

Bee paralysis, O. O. POPPLETON (*Gleanings in Bee Culture, 27 (1899), No. 14, pp. 537, 538*).—A brief discussion of the means of transmission of this disease.

Sericulture and silk reeling from the cocoons by machinery (*U. S. Spec. Consular Rpts., 15 (1899), pt. 2, pp. 131-152, pls. 2, figs. 8*).—In answer to a request from the Department of State addressed to the consuls in France and Italy regarding machines for reeling silk from cocoons, reports were made which are published under the above title. Besides descriptions of the process of reeling and the machines used for that purpose in the countries mentioned, the consuls have reported also upon various features of the rearing, care, and life history of the silkworms in the countries where they made their investigations.

The larval stage of Hypoderma bovis, P. KOOREVAAR (*Ann. Mag. Nat. Hist., 4 (1899), No. 19, pp. 69–73; trans. from Tijdschr. Nederl. Dierk. Ver., 2. ser., 1898, pt. 5, pp. 29–34*).—*Hypoderma bovis* larvæ were found in the spinal canal of a calf. Experimentally placed beneath the skin of a dog, they were found later in the peritoneal cavity, in the fat around the kidneys, and in various other tissues.

A contribution to the biology and classification of the Muscidæ, E. GIRSCHNER (*Ent. Nachr., 25 (1899), No. 12, pp. 177–186, fig. 1*).—Gives systematic notes on a number of the genera of Muscidæ.

Changed conditions in the life of mosquitoes, K. SAJO (*Prometheus, 10 (1898), No. 477, pp. 138–141*).—The author observed that in a ditch where water was usually present during the breeding season for mosquitoes no larvæ could be found, although large numbers of them were found in a tub of water which stood in the garden. The author attributes the absence of mosquito larvæ in the ditch to the attacks of various predaceous water bugs and beetles.

Some insects injurious to stock and remedies therefor, G. W. HERRICK (*Mississippi Sta. Bul. 53, pp. 8*).—The bulletin contains brief biological notes and accounts of the most approved methods of prevention of the following insects: Horn fly (*Hæmatobia serrata*), southern buffalo gnat (*Simulium pecuarum*), horse botfly (*Gastrophilus equi*), screw-worm fly (*Compsomyia* (*Lucilia*) *macellaria*), sheep botfly or head magot (*Œstrus ovis*), ox botfly or warble fly (*Hypoderma bovis*).

Insects: Their structure and life, G. H. CARPENTER (*London: J. M. Dent & Co., 1899, pp. XI+404, figs. 184*).—This work is divided into 6 chapters with the following titles: The form of insects, the life history of insects, the classification of insects, the orders of insects, insects and their surroundings, and the pedigree of insects. At the end of the volume is found a bibliography of 11 pages.

A contribution to a knowledge of the faunistic entomology of Ohio, F. M. WEBSTER (*Ent. News, 10 (1899), No. 5, pp. 134–144*).—A short popular account of the manner of distribution in Ohio of a number of economic insects.

Some insects of the year, E. A. POPENOE (*Trans. Kansas State Hort. Soc., 23 (1898), pp. 40–46*).—Contains notes on the apple-leaf crumpler, the lesser apple-leaf folder, the fall webworm, the handmaid moth, two mulberry borers (*Dorcaschema wildii* and *D. alternatum*), the apple curculio, the northern lady bird, *Aspidiotus forbesii*, and the fruit bark beetle (*Scolytus rugulosus*).

Collection, preservation, and distribution of New York insects, E. P. FELT (*Bul. New York State Mus., 6 (1899), No. 26, pp. 31, figs. 29*).—This bulletin contains directions for making the apparatus which is necessary in collecting insects; an outline of special methods in collecting insects of different habits; a discussion of the technique of preserving, mounting, labeling, and preserving insects; and hints on the study of the distribution of insects and on life zones.

Entomological report for the years 1897, 1898, F. SINTENIS (*Sitzber. Naturf. Gesell. Dorpat, 12 (1898), No 1, pp. 74–89*).—Notes on the habits and biological relations of a large number of insects.

Insect attacks in 1898, R. S. MACDOUGALL (*Trans. Highland and Agr. Soc. Scotland, 5. ser., 11 (1899), pp. 287–293*).—Notes are given on the habits, occurrence, and remedies to be adopted in case of attacks from the black currant gall mite (*Phytoptus ribis*), pear gnat midge (*Diplosis pyrivora*), the pine sawfly (*Lophyrus pini*), and the fox pine sawfly (*L. rufus*).

Insect and fungus diseases of fruit trees and their remedies, with notes on the treatment of some garden and vegetable pests, ALLEN, BLUNNO, FROGGATT, and GUTHRIE (*Dept. Agr. New South Wales, Misc. Pub. No. 238, pp. 78, pls. 20, figs. 49*).—This publication contains economic notes on the habits and life history of injurious insects and parasitic fungi which attack common fruit trees and garden vegetables. In connection with all the injurious insects and parasitic fungi which are discussed the appropriate remedies are suggested. The fruit trees and vegetables, the enemies of which are treated, are as follows: Apple, pear, quince, almond, peach, apricot, cherry, plum, fig, citrus trees, grapevine, potato, tomato, cabbage, beans, pumpkin, melons, squashes, cucumbers, and strawberry.

Shade-tree pests in New York State, E. P. Felt (*Bul. New York State Mus., 6 (1899), No. 27, pp. 39–60, pls. 5, figs. 8*).—In this paper the author discusses the economic relationship of the following insects: White-marked tussock moth, elm-leaf beetle, elm-bark louse, tent caterpillars, fall webworm, maple-tree borer, elm-tree borer, pigeon tremex, leopard moth, and the cottony maple scale insect. In connection with the discussion of each insect the author mentions briefly those remedies which are especially effective against the species in question. At the end of the bulletin are found general remarks on the subject of spraying, rules for spraying, the most appropriate apparatus, and directions for making and applying Paris green, London purple, kerosene emulsion, and whale-oil soap.

Enemies of the tea bush and other pests. Report of the honorary entomologist of Ceylon (*Planting Opinion, 4 (1899), No. 18, pp. 339, 340*).—Gives economic notes on *Orthezia insignis, Helopeltis antonii, Xyleborus fornicatus, Orygia postica*, and speaks of the introduction of beneficial ladybirds.

How to handle the striped beetle on cucumbers, F. H. Hall and F. A. Sirrine (*New York State Sta. Bul. 158, popular ed., pp. 6, fig. 1*).—This is a popular summary of Bulletin 158 of the station (see p. 269).

Sweet-potato beetles, E. D. Sanderson (*Country Gent., 64 (1899), No. 2422, p. 511, figs. 3*).—Notes on tortoise beetles and flea-beetles, with suggestions of remedies.

The enemies of the potato, E. Roze (*Histoire de la pomme de terre. Paris: J. Rothschild, 1898, pp. 257–263*).—In this section of his work the author gives a brief discussion of *Melolontha vulgaris, Doryphora decimlineata, Bryotropha solanella, Julus guttulatus*, and *Tylenchus devastatrix*.

Combating enemies of potatoes, M. V. Slingerland (*Amer. Agr., (mid. ed.), 63 (1899), No. 20, p. 612*).—Popular notes on the Colorado potato beetle and potato flea-beetle, with a discussion of remedies.

The boll weevil pest—how it may be dealt with and eradicated, F. W. Mally (*Cotton Ginners' Jour., 3 (1899), No. 5, p. 9*).

Fighting the boll weevil, F. W. Malley (*Texas Farm and Ranch, 18 (1899), No. 24, pp. 3, 4*).—Calls attention to the fact that cotton fields are infested in limited areas and urges the immediate destruction of the weevil in these areas.

Luring the grapevine borer, K. Sajo (*Prometheus, 9 (1898), No. 467, pp. 801–801, fig. 1*).—The insect in question (*Rhychites betuleti*) has a habit of making nests by rolling leaves together. The insect has a decided preference for pear leaves. The author found that a few pear trees located in the vineyard, upon which the leaves were unfolded considerably earlier than on the grapevines, served as trap trees in enticing the beetles to make their nests of the pear-tree leaves. It was then an easy matter to jar the beetles from the pear trees into canvas traps and thus prevent their injury to the grapevines.

A pear-tree destroyer (Agrilus sinuatus), M. P. Passy (*Garden, 56 (1899), No. 1443, pp. 35, 36*).—Contains a description of the insect, a brief account of its life history, and suggestions of remedies, among them being the smearing of the trunk and large branches with tar or lime and cutting the larvæ from the branches.

The phylloxera question, A. J. Perkins (*Jour. Agr. and Ind., South Australia, 2 (1899), No. 11, pp. 889–893*).—Discusses the dangers from infestation with phylloxera, quarantine regulations, and the planting of American vines.

Notes on fruit-maggot flies with descriptions and new species, W. W. Froggatt (*Agr. Gaz. New South Wales, 10 (1899), No. 6, pp. 497–504, pls. 3*).—The author gives a technical description with notes on the life history of the following fruit-maggot flies: *Tephrites tryoni, T. psidii, Halterophora capitata, Trypeta musæ*, and *T. pomonella*. *T. psidii* is described as a new species and was reared from guavas. *T. musæ* is also a new species and was reared from decaying bananas. The author recommends the same line of treatment for all of these fruit-maggot flies. Various experiments tried by different fruit growers in spraying with a solution which was distasteful to the insects were without success. A trap which has proved rather successful in catching the adult flies consists of a candle supported in a tin surrounded by a few inches of kerosene and water and placed under the infested trees.

All the late peaches and persimmons should be gathered and boiled in order to destroy the late brood of maggots. Thorough cultivation of the ground in winter will have the effect of exposing the chrysalids to fatal climatic changes and other enemies.

Coccidæ which menace the fruit culture of Europe, A. Berlese and G. Leonardi (*Riv. Patol. Veg., 7 (1898), Nos. 5-8, pp. 252-260, figs. 4*).—A discussion of the distribution of the San José scale, of the possibility of its introduction into Italy, and of scales which might be confused with it.

The more recent literature on the San José scale, K. Sajo (*Prometheus, 10 (1898), No. 480, pp. 186-188*).—The author discusses the problem of kerosene spraying for San José scale as illustrated by the results of recent experiments in America.

Lessons from the year's work with the San José scale, S. A. Forbes (*Trans. Illinois State Hort. Soc., 1898, pp. 50-62*).—This article contains a general account of the extent of distribution of the insect in the State and of the means which have been adopted for holding it in check or exterminating it. Insecticide operations were carried on with whale-oil soap at 21 out of 25 places of infestation. The operations were begun at the time the leaves fell in November and were continued until the leaves began to unfold in the spring. On an average 98 per cent of the scales were destroyed. The author believes that if it should prove to be impossible to eradicate the San José scale, its injuries can be reduced to comparative insignificance by a single insecticide treatment applied every other year.

Some scales of the orchard, P. J. Parrott (*Trans. Kansas State Hort. Soc., 23 (1898), pp. 106-109, figs. 2*).—Notes on *Mytilaspis pomorum*, *Chionaspis furfurus*, *Aspidiotus uvæ*, *A. fernaldi*, *A. ancylus*, *A. ostreæformis*, and *A. forbesii*.

A dangerous European scale insect not hitherto reported but already well established in this country, C. L. Marlatt (*Science, n. ser., 10 (1899), No. 236, pp. 18-20*).—*Aspidiotus ostreæformis* is a well known pest on various fruit trees of Europe. It is widely distributed in Europe, specimens having been received from Germany, England, and Italy. There is considerable evidence that the insect has existed in this country for about 8 or 10 years in Ohio and New York. The insect has repeatedly been identified wrongly, being referred to 2 or 3 other species of the same genus. The earliest material from this country which is definitely to be referred to the species in question bears the date of January 12, 1895, and came from the Geneva Station of New York. It has been reported from this country as occurring on plum, cherry, apple, pear, prune, and currant. The localities from which specimens have been received are Ohio, New York, British Columbia, Ontario, and Iowa. It was found at numerous points in New York and Ohio.

The author believes the species to be the same as the species which have gone under the names of *A. spurcatus* and *A. zonatus*. In Europe the species has been found on *Prunus domestica*, *Populus tremuloides*, and *Platanus orientalis* beside on the common fruit trees.

My experience in spraying in Illinois orchards for scale insects, R. W. Braucher (*Trans. Illinois State Hort. Soc., 1898, pp. 24-30*).—The author was employed under the direction of S. A. Forbes to superintend the spraying of various orchards in the State for the San José scale by means of whale-oil soap. In one test 1,444 trees were sprayed. It required 5½ days to do the work and 682 lbs. of soap. Of these 1,335 were afterward inspected and living scales were found on 107 of them, or on slightly more than 8 per cent.

Some common sources of error in recent work on Coccidæ, C. L. Marlatt (*Science, n. ser., 9 (1899), No. 233, pp. 835-837*).—The author criticises the establishing of species upon mere differences of habit and exterior appearance without reference to their characters or actual experimental demonstration of specific difference.

Seed and soil treatment and spray calendar, W. J. Green et al. (*Ohio Sta. Bul. 102, folio*).

Spraying calendar, L. R. Taft (*Michigan Sta. Spec. Bul. 12, folio*).—This gives the formulas for the more common insecticides, with suggestions as to the time for applying these insecticides for the destruction of common insects and fungus diseases.

Spraying calendar for 1898, L. R. Taft (*Michigan State Hort. Soc. Rpt. 1897, pp. 324–339*).—A reprint of Michigan Station Bulletin 155 (E. S. R., 10, p. 470).

Nurseries and orchard inspection, U. P. Hedrick (*Michigan State Hort. Soc. Rpt. 1897, pp. 147–150*).—An outline of the regulations which were adopted for the prevention of the introduction and spread of the San José scale and other insects in the State of Michigan.

The need of nursery inspection laws, O. E. Fifield (*Michigan State Hort. Soc. Rpt. 1897, pp. 150–165*).—The author discusses the status of nursery inspection laws in Michigan and other States. The article contains a copy of the bill which was adopted by the American Association of Nurserymen to provide rules and regulations for the inspection of trees.

A law for the extermination of locusts, F. Insfran and C. R. Saguier (*Riv. Agr. Cien. Apl., Paraguay, 1 (1898), No. 8, pp. 348–351*).—A statement of the law adopted for the extermination of locusts in Paraguay.

Horticultural legislation, R. D. Graham (*Michigan State Hort. Soc. Rpt. 1897, pp. 30–38*).—A statement of the State law concerning the inspection of nurseries and orchards and a discussion of the necessity for this law and the good results which are to be hoped for from it.

On a fungus disease of the green scale, A. Zimmermann (*Teysmannia, 9 (1898), No. 5, pp. 240–243*).—*Lecanium viridi* is reported as being attacked and destroyed by *Cephalosporium lecanii.*

A fungus disease of Lecanium viride, A. Zimmermann (*Teysmannia, 9 (1898), No. 5, pp. 240–243; abs. in Centbl. Bakt. u. Par., 2. Abt., 5 (1899), No. 9, p. 323*).—The author describes a fungus that has proved very destructive to the green scale (*Lecanium viride*).

On the distribution in Italy of Entomophthora planchoniana and its importance in horticulture and agriculture, O. Mattirole (*Staz. Sper. Agr. Ital., 31 (1898), No. 3, pp. 315–326*).—The spread of this fungus disease of insects in Italy is described, and an account is given of its effectiveness in destroying insects.

FOODS—ANIMAL PRODUCTION.

The nutritive value of asparagin, B. K. Brutskus (*Zap. Novo-Alexandri Inst. Selsk. Khoz. i Lyesov, 11 (1898), No. 11, pp. 145–228*).—The author reviews exhaustively the literature on the nutritive value of asparagin for herbivora, birds, carnivora, and omnivora, including man. In addition, 2 experiments with rabbits are reported.

The general plan was to feed a ration containing no protein in 1 period and to compare this with a similar ration in which part of the nonnitrogenous material was replaced by asparagin.

The first experiment was divided into 2 periods of 22 and 26 days, respectively. In the first period the daily ration consisted of 640 gm. of rice starch, 120 gm. of birch sawdust, 75 gm. of sugar, 30 gm. oil, 20 gm. salt, 20 gm. hay ashes, 10 gm. barley ashes, 34.4 gm. water, and 150 gm. asparagin. In the second period no asparagin was fed, and the amount of starch was increased to 725 gm., the other ingredients remaining the same. In the first period the daily income of nitrogen was 0.815 gm., 0.778 gm. being supplied by asparagin. The outgo in the urine was 0.870 gm. and in the feces 0.068 gm.; that is, there was a daily loss of 0.123 gm. nitrogen. The average amount of sulphur excreted in the urine daily was 0.123 gm. During this period the rabbit lost 195 gm. in weight, or 13.8 per cent of its total weight. Between the first and second period there was an interval of about 4 weeks, during which time the rabbit was fed barley and potatoes. At the beginning of the second period it had regained its original weight. During the second period the average daily income of nitrogen was 0.041 gm. and the outgo in the urine 0.195 and in the feces 0.042 gm.; that is, there was a daily loss of 0.196 gm. nitrogen. The urine contained on an average 0.0161 gm. sulphur daily. During the second period the rabbit lost 250 gm., or 16.7 per cent of its total weight.

In the first period of the second test, which covered 18 days, the rabbit was fed the ration mentioned above which contained no asparagin. The daily food furnished 0.031 gm. nitrogen, the outgo in the urine was 0.328 gm. and in the feces 0.076 gm.; that is, there was a daily loss of 0.373 gm. nitrogen. The average excretion of sulphur in the urine was 0.0215 gm. The rabbit lost 20 per cent of its weight during this period, or 16.1 gm. daily. The second period (in which asparagin was fed) was not completed.

The author concludes that his results confirm those of Bahlmann, showing that the value of asparagin in a diet containing no protein is much higher than that of an isodynamic quantity of starch, and, further, that although asparagin can not replace albumin in a diet, it may prevent the cleavage of about one-fourth of the quantity of protein which would be broken down in the body when no nitrogen was consumed.—P. FIREMAN.

The influence of removal of the large intestine and increasing quantities of fat in the diet on general metabolism in dogs, V. HARLEY (*Proc. Roy. Soc. [London], 64 (1898), No. 407, pp. 77-88*).—A number of experiments are reported with dogs on the effect of removing the large intestine and increasing the amount of fat in the diet. Analyses are reported of the food, urine, and feces. The author summarizes his results as follows: The large intestine has no effect on the absorption of carbohydrates in the diet, but its absence causes a marked decrease in the absorption of proteids, the amount varying from 93 to 84 per cent. Fat is absorbed in practically normal amounts and the breaking up of fat also continues:

> "The water of the feces is increased in total quantity, although the percentage of water increases with an increased fat diet, instead of decreasing as in normal dogs. The total quantity of feces is also increased on the same diet as that in the normal dogs, and the cholesterin is decreased.
>
> "The formation of urobilin in the feces is diminished in the absence of the large intestine; the sulphates vary the same as the normal as regards those combined with alkalis, while those combined with the aromatic substances are markedly diminished, showing that intestinal putrefaction is decreased."

Digestion experiments, F. E. EMERY (*North Carolina Sta. Bul. 160, pp. 187-204*).—In continuation of previous work (E. S. R., 10, p. 667) experiments with sheep are reported on the digestibility of crab-grass hay alone and in combination with cowpea meal, corn bran and rice bran, and first and second growths of green rape. An unsuccessful attempt was also made to feed peanut meal, a coarsely ground by-product.

The usual experimental methods were followed and the same sheep were used as in previous experiments at the station. The tests with rape were made with 4 sheep, the others with 2. The composition of the different feeding stuffs used is reported. The results of the tests are summarized in the following table:

Coefficients of digestibility of various feeding stuffs by sheep.

	Dry matter.	In dry matter.					
		Protein.	Albuminoids (albuminoid nitrogen × 6.25).	Ether extract.	Nitrogen-free extract	Crude fiber.	Ash.
	Per ct.	*Per ct.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per ct.*	*Per ct*
Crab-grass hay	54.9	32.0	28.8	35.6	52.8	64.40	51.8
Crab grass hay and cow pea meal 1:1	70.9	70.5	69.8	54.7	76.5	64.30	45.9
Calculated digestibility of cowpea meal alone	86.6	82.0	82.0	73.9	93.1	64.00	33.5
Crab-grass hay and corn bran	66.1	48.7	48.3	69.1	74.5	59.70	16.5
Calculated digestibility of corn bran alone	70.5	53.4	53.7	72.3	79.6	53.10	....
Green rape	84.8	88.8	86.4	48.5	92.0	87.00	62.7
Green dwarf Essex rape	88.5	90.2	86.6	54.2	93.8	90.00	76.5
Crab grass hay and rice bran	59.7	52.4	52.6	82.3	66.0	56.00	26.3
Calculated digestibility of rice bran alone	64.7	62.9	64.7	88.6	78.2	29.20	2.4

Digestion experiments with steers, G. L. HOLTER and J. FIELDS (*Oklahoma Sta. Bul. 37, pp. 20*).—The digestion experiments summarized in a previous publication (E. S. R., 10, p. 983) are reported in full. The bulletin also contains the analyses of Kafir-corn fodder (whole plant and different parts), corn fodder (whole plant and different parts), alfalfa, sorghum, black rice corn, milo maize, teosinte, and chufas. Fertilizer constituents were also determined in Kafir fodder from the stack, ashes from stable manure, the soil from roots of castor bean plants, and the soil between rows of castor beans.

Skim milk as a food for young growing chickens, W. B. ANDERSON (*Indiana Sta. Bul. 76, pp. 21-28*).—This test, which is regarded as a duplicate of one previously reported (E. S. R., 10, p. 677), was made with 2 lots, each composed of 10 Plymouth Rock and Houdan chickens, to study the value of skim milk as part of a ration. The test began July 16 and covered 42 days. Both lots were fed a grain ration consisting of equal parts of corn meal, shorts, and ground oats, and in addition, rape, cabbage, and lettuce. Lot 2 was also fed skim milk *ad libitum*. All the chickens were fed three times a day, and were given the same care and treatment. At the beginning of the test each lot weighed 259 oz. During the test lot 1 consumed 732 oz. of grain, 4 oz. of rape, and 43.5 oz. of cabbage; lot 2, 912 oz. of grain, 752 oz. of skim milk, and the same amount of rape and cabbage as lot 1. Lot 1 gained 7¾ lbs. and lot 2 14⅜ lbs.

Basing the financial statement on oats at 80 cts., corn meal at 80 cts., shorts at 60 cts., and skim milk at 20 cts. per 100 lbs., the cost of food per pound of gain was found to be 4½ cts. for lot 1 and 3½ for lot 2.

The test is compared with that previously reported. From the present trial the following conclusions are drawn:

"The results of this trial are very similar to those of the previous one, with the single exception that skim milk did not decrease in value as a food for young chickens, as the chickens became older and cooler weather prevailed.

"Green food given to young fowls confined in pens will not keep them in perfect health when getting a fairly balanced ration. This indicates that the young chickens are unable to digest and assimilate all the nutrients from the ground food.

"Skim milk is a valuable food for chickens. Whether fed with a balanced ration or with green food, its influence is very great in securing increased weight and in maintaining the general health of the fowls.

"The addition of skim milk to the ration increases the profits by decreasing the cost of the ration and by securing greater returns from the other foods given, especially when the chickens are young and confined in pens or small yards."

The manufacture of preserved foods and confectionery, A. HAUSNER (*Die Fabrication der Conserven und Canditen. Vienna: A. Hartleben, 1899, 3. ed., ill.; rev. in Oesterr. Chem. Ztg., 2 (1899), No. 7, p. 183*).

Book of diet, P. E. MUSKETT (*Melbourne, Sydney, Brisbane, Adelaide, London: George Robertson & Co., 1898, pp. 301*).—The author discusses the principal foods and their value as nutrients with especial reference to Australian conditions. A number of receipts for preparing food are also given.

The adulteration of flour, W. A. WITHERS and G. S. FRAPS (*North Carolina Sta. Bul. 156, pp. 59-67*).—The adulteration of flour is discussed and the examination of 50 samples purchased in North Carolina reported. Sixteen per cent were found adulterated with corn flour or corn meal, most of the adulterated samples being cheap flour. No clay, soapstone, or similar substance was detected in any of the samples examined. One sample contained alum.

Mineraline, W. A. WITHERS and H. W. PRIMROSE (*North Carolina Sta. Bul. 157, pp. 71-76*).—The attempt of a North Carolina company to introduce mineraline as an adulterant for wheat flour is noted. Judging from analyses this substance consists of ground talc.

Brief notes are also given of the examination of coffee, bread, bran, and cottonseed meal.

Baking powders on sale in North Carolina, W. A. WITHERS and J. A. BIZZELL (*North Carolina Sta. Bul. 155, pp. 51-56*).—In addition to describing baking powders and their principal ingredients, the authors report the analyses of 25 samples of baking powder purchased in North Carolina. Eighty-one per cent of the samples analyzed contained alum and 56 per cent were straight alum powders. Two samples were apparently so old as to be useless for the purpose for which intended.

Sugar as food, MARY H. ABEL (*U. S. Dept. Agr., Farmers' Bul. 93, pp. 27*).—The extent and use of sugar, the sources of cane sugar, the food value of sugar, and the use of sugar in the dietaries of adults and children are treated of. Among the general conclusions drawn are the following:

"One may say in general that the wholesomeness of sweetened foods and their utilization by the system is largely a question of quantity and concentration.

"From a gastronomic point of view it would seem also that in the American cusine sugar is used with too many kinds of food, with a consequent loss in variety and piquancy of flavor in the different dishes. The nutty flavor of grains and the natural taste of mild fruits is concealed by the addition of large quantities of sugar.

"In the diet of the under-nourished larger amounts of sugar would doubtless help to full nutrition. This point is often urged by European hygienists. In the food of the well-to-do it is often the case, however, that starch is not diminished in proportion as sugar is added. That sugar on account of its agreeable flavor is a temptation to take more carbohydrate food than the system needs can not be denied. The vigor of digestion in each particular case would seem to suggest the limit. A lump of sugar represents about as much nutriment as an ounce of potato, but while the potato will be eaten only because hunger prompts, the sugar, because of its taste, may be taken when the appetite has been fully satisfied.

"Sugar is a useful and valuable food. It must, however, be remembered that it is a concentrated food and therefore should be eaten in moderate quantities. Further, like other concentrated foods, sugar seems best fitted for assimilation by the body when supplied with other materials which dilute it or give it the necessary bulk.

"Persons of active habit and good digestion will add sugar to their food almost at pleasure without inconvenience, while those of sedentary life, of delicate digestion, or of a tendency to corpulency would do better to use sugar very moderately. It is generally assumed that 4 or 5 oz. of sugar per day is as much as it is well for the average adult to eat under ordinary conditions."

Preserving eggs, E. F. LADD (*North Dakota Sta. Bul. 35, pp. 330–332*).—Water glass was found to be a satisfactory preservative for eggs. Directions are given for the preparation of a solution for this purpose.

A study of the causes of the red color which is produced in meat by boiling, together with experiments on the effect of sulphurous acid on the color of meat, K. KISSKALT (*Arch. Hyg., 35 (1899), No. 1, pp. 11–18*).

German laws on meat inspection, OSTERTAG (*Ztschr. Fleisch u. Milchhyg., 9 (1899), No. 8, pp. 141–145*).—Brief directions for meat inspectors.

On the determination of the age of beef carcasses, BUNGE (*Ztschr. Fleisch u. Milchhyg., 9 (1899), No. 8, pp. 145–147*).—Contains practical suggestions for the guidance of inspectors.

Commercial feeding stuffs in the Connecticut market (*Connecticut State Sta. Bul. 128, pp. 12*).—Cotton-seed meal, gluten meal, and other products made from a single grain, and feeding stuffs prepared from two or more grains, are discussed. The average composition of feeding stuffs purchased in Connecticut markets is reported. These were examined chemically and microscopically. These were cotton-seed meal, linseed meal, gluten meal, gluten feed, wheat bran, wheat middlings, mixed feed, rye bran, whole oats, corn meal, oat feed, oat chaff, malt hulls, Quaker dairy feed "stock food," "starch feed," provender, standard dairy feed, H. O., H. O. horse feed, Blatchford's calf meal, and Baum's horse and stock food.

Feeding-stuff inspection, C. D. WOODS (*Maine Sta. Bul. 51, pp. 16*).—Analyses, made in compliance with the State feeding-stuff law, are reported of a number of samples of cotton-seed meal, Chicago gluten meal, cream gluten meal, King gluten meal, Buffalo gluten feed, Rockford Diamond gluten feed, sucrene oil meal, Cleveland flax meal, old-process linseed meal, Blatchford calf meal, Victor corn and oat feed, corn and oat feed, ground corn and oats, Lakeside corn and oat feed, Dundee corn and oat feed, Monarch corn and oat feed, H. O. Co. standard dairy feed, H. O. Co. horse feed, H. O. Co. poultry feed, American Cereal Co. poultry feed, Quaker oat feed, Haskell oat feed, Crescent oat feed, Horseshoe brand ground beef cracklings for poultry, Bradley superior meat meal, Bowker pure beef scraps, Bowker animal meal, pure beef scraps, and American poultry meal. The analyses of cotton-seed meal and gluten meal are briefly discussed.

DAIRY FARMING—DAIRYING.

Annual forage plants for summer pasture, T. L. LYON and A. L. HAECKER (*Nebraska Sta. Bul. 58, pp. 57–70, fig. 1*).—In comparison with alfalfa, the following were tested as forage plants for dairy cows: Rye, oats and peas, hairy vetch, corn, millet, sorghum, white Kafir corn, yellow millo maize, soy beans, and cowpeas. The crops were grown on fifth-acre plats for pasturage, and under similar conditions on tenth-acre plats for the purpose of determining the amount of green forage produced. The treatment of the different plats, the number of days each furnished pasturage for one cow, and the amount of green forage cut from the duplicate plats at the most favorable periods of growth are given. In conducting the test with each crop, a cow was pastured (1) on alfalfa for one month, (2) on the test crop as long as it afforded sufficient feed, and (3) on alfalfa for one month. The tabulated data include the gain or loss in weight of the animal during each period and the average daily production of milk and butter fat. Of the plants tested, sorghum furnished the greatest amount of pasturage. It is noted in this connection that the amount of pasturage furnished by each plat could not be accurately judged by the amount of forage produced on duplicate plats and that the waste in pasturing was least with oats and peas and hairy vetch and greatest with corn and Kafir corn.

Comparing the average results from the two periods on alfalfa with those on the different test crops, it was found that with the exception of hairy vetch, soy beans, and cowpeas, the increase in live weight during the time the cows were on the test crops greatly exceeded that made on alfalfa. With the exception of the cow pastured on cowpeas, the yield of milk was slightly decreased in each case. "White Kafir corn, rye, sorghum, and hairy vetch maintained the milk flow excellently well." The production of butter fat increased with rye, soy beans, and cowpeas and decreased in the other cases. Excluding the test of yellow-millo maize as unsatisfactory, millet was considered as making the poorest showing and corn next.

The effect of food on economic dairy production, A. M. SOULE (*Texas Sta. Bul. 47, pp. 1033-1106, figs. 6, dgms. 8*).—Ten grade Jersey and 8 grade Holstein cows were divided into 6 lots of 3 cows each and fed for 56 days, the time being divided into 4 equal periods. In the first period all the lots were given a nearly uniform ration of cotton-seed meal, hulls, and silage. In the 3 subsequent periods, lot 1 had cotton-seed meal and hulls; lot 2, cotton-seed meal and sorghum hay; lot 3, cotton-seed meal and hulls with silage, and lots 4, 5, and 6, cotton-seed meal and silage with bran, corn meal, and oats, respectively. The proportion of cotton-seed meal to the other components of the ration was diminished from the second to the fourth period in the case of each lot.

The data for the experiment, showing the previous record of the cows, composition of the food materials used, computed digestible nutrients in the daily rations, with cost and manurial value, variations in weight of animals during the experiment, amount and character of food consumed, milk and butter produced, variations in fat as influenced by food and temperature, etc., are presented in detail in tables and diagrams and discussed at great length. Some of the tables are difficult to comprehend, as it is not clear whether the data refer to individuals in the same period or to averages for lots in different periods.

The author concludes that the use of some other grain feed with the cotton-seed meal was more effective and economical than the use of cotton-seed meal and coarse food alone. "The use of 6 lbs. of cotton-seed meal (when the only meal fed) gave a larger profit and proved more effective than the use of 7, 8, or 10 lbs. When 4 to 6 lbs. of cotton-seed meal were combined with 6 or 4 lbs. of bran, corn meal, or oats, the best yields of milk and butter were secured."

Of the 19 rations fed, one composed of 6 lbs. of cotton-seed meal, 18 lbs. of cotton-seed hulls, and 35 lbs. of corn silage is said to have been the most economical for dairy production. The best returns were secured when the nutritive ratios ranged between 1.5 and 1.6. The author states furthermore that "when the proportion of protein and fats furnished in the meals was least and the carbohydrates greatest the yields and profits were the highest" and "when one third of the total digestible nutrients consumed per day was furnished by the meals the best financial results were observed. . . . Rations decidedly at variance with the so called standard rations gave excellent returns from a financial standpoint."

A sudden change of temperature from 49 to 19° F. in 24 hours materially reduced the yields of milk and butter fat for several days. The average cost for the 6 groups of 100 lbs. of milk and 1 lb. of butter, including only the cost of feeding materials at the market prices during the experimental periods, varied from 50.4 cts. to 65.2 cts. and from 10.9 cts. to 14.1 cts., respectively. "Cows will eat more food than they can profitably manufacture into dairy products. They may also suffer from lack of a sufficient supply of certain food ingredients. . . . Conformation is of importance in the dairy cow."

The composition of milk and milk products, H. D. RICHMOND (*Analyst, 24 (1899), Aug., pp. 197–201*).—The author summarizes the results of analyses of 14,135 samples of milk brought in by the railroads from different farms, the averages being given of the morning's and night's milk by months; analyses of 50 samples of normal milk, including determinations of sugar, proteids, and ash in addition to the usual determinations; analyses of a number of samples of abnormal milk; average composition of clotted cream; and composition of butters and separator slime. The analyses of normal milk "confirm Vieth's ratio of sugar, proteids, and ash of 13:9:2, to a remarkable degree. The ratio found is 12.8:9.3:2, which is in excellent agreement."

The author discusses the theory of Storch that a slimy albuminous membrane surrounds the fat globules of milk (E. S. R., 9, p. 176), and presents some data bearing on the subject. From a review of the evidence, he concludes that he is "unable to see that there is any justification for the view that each globule in milk is surrounded by a mucoid membrane; certainly the question is far from being settled by Storch's results."

Effect of sesame cake on butter, PFEIFFER (*Ber. Landw. Vers. Stat. Univ. Jena, 1898, pp. 12–14*).—This experiment was made to determine whether any injustice might arise from the German law of

1897 requiring the mixing of at least 10 per cent of sesame oil with oleomargarine as a means of identifying it. Seven cows were fed a basal ration of coarse fodder during a number of periods, to which various oil cakes were added in different periods, the amount of sesame cake being gradually increased from ½ lb. up to 4 lbs. per head daily. The butter was examined for iodin number and for sesame oil by the Baudouin reaction (shaking with furfurol and hydrochloric acid). It gave no reaction for sesame oil in any case, indicating that no transmission of the oil to the butter was to be feared. This result is said to agree with most of the experiments on this point. [See, however, E. S. R., 9, p. 795; 10, pp. 586, 587.] It was found that the iodin number increased regularly with the increase in amount of sesame cake which was fed.

Spongy curd and the effect of sewage, LLOYD (*Abs. in Dairy, 11 (1898), No. 127, p. 197*).—An instance is cited in which cows twice by accident got into a paddock and waded in and drank from a pool of stagnant dirty water. Each time a spongy curd was produced. To make sure that the water was the cause a bacteriological examination was made, and one of the most typical spongy organisms was found in it as well as in the spongy curd. It was found that the sewage from a number of cottages overflowed into this paddock, and as soon as the difficulty was removed the spongy curds ceased.

Ropiness in milk and cream, A. R. WARD (*New York Cornell Sta. Bul. 165, pp. 395–412, pl. 1*).—The literature of this subject is reviewed and an account is given of an investigation of an outbreak in two dairies. The cause of the ropiness was found to be *Bacillus lactis viscosus*, but considerable difficulty was experienced in locating the point at which the infection took place. The first complaint came from a local milk dealer who was losing his customers on account of the milk becoming ropy after standing. All of the milk handled by this dealer was supplied by one dairy of 12 cows. The cream on the surface of cans of milk which stood in water at a temperature of from 45 to 50° F. became viscid in from 24 to 48 hours. No complaint was heard from customers who consumed the milk within a few hours. Samples of the milk taken directly from the cows failed to show the presence of the bacillus or to become ropy. Cultures of the air and filth of the stable and of the feces of the cows gave no evidence of the presence of the bacillus. The milking utensils were then carefully examined and it was found that "the milk did not contain *Bacillus lactis viscosus* when drawn from the udder, nor did it gain access to the milk during any of the processes to which the milk was subjected up to the time that it was taken from the barn." From the barn the evening's milk was brought to the creamery and placed for the night in deep-setting cans surrounded by ice water, while the morning's milk was aerated and brought to the creamery, where it was again strained before delivering. The brass-wire strainer used for straining the milk was found to be in a filthy condition through lack of thorough cleaning, but the deep setting cans were apparently clean.

Samples of milk exposed to contamination on the surface of the strainer became viscid, as well as samples which were taken from the interior of the deep-setting cans, and a bacteriological examination showed the presence of *Bacillus lactis viscosus.*

At another dairy which had suffered seriously from ropiness, the cause of the contamination was located in the utensils used for holding the milk before and during delivery. As a remedy it was suggested that "the smaller utensils be totally immersed in boiling water for three minutes and that the larger cans be filled to the brim with boiling water for a like length of time." This suggestion was carried out, and the trouble immediately disappeared.

The author was unable to determine the source from which the bacillus originally reached the milk cans, but, in view of the work of Adametz, he is inclined to believe that during warm weather these particular bacteria got into the milk from water.

In conclusion a description is given of the bacillus found in the samples of ropy milk, and its behavior in various cultures.

Pure cultures for Cheddar cheese making, J. R. CAMPBELL (*Trans. Highland and Agr. Soc. Scotland, 5. ser., 11 (1899), pp. 205–220*).—This is a continuation of previous investigations in this line (E. S. R., 10, p. 996). Experiments were made in the laboratory and in the dairy which demonstrated the purifying effect of the method employed by the dairymen in preparing starters. The method followed in preparing this homemade starter is to allow a quantity of skim milk to sour spontaneously, skim off the surface, and add about a pint to a pailful of skim milk which has been scalded to 155 to 160° F. and subsequently cooled to 65 to 70°. This process is repeated each day, and on the third day the product may be used for the starter, a portion being retained for the starter for the following day. This may be continued throughout the season.

"By starting with an ordinary sample of sour milk, even though it be impure, the operations entailed in preparing what I have designated 'a homemade starter' will, in a very few days, produce a sample of sour milk containing what is for all practical purposes a pure culture of the bacterium required for the manufacture of good cheese. If the cheese maker begins with an absolutely pure culture, in the course of a few days it will be no purer and in no way better for cheese making than the cultivation obtained by the homemade-starter system."

Two series of experiments in July and August were made at 5 different dairies to compare the homemade starter with a number of pure cultures in practical use in cheese making. The cheeses were scored by competent judges who knew nothing of the method of making. The results of these experiments are tabulated.

The sum total from these experiments may be stated as follows:

"(1) First-class Cheddar cheese can be made by using pure cultures of a lactic organism.

"(2) This organism abounds in all samples of sour milk and sour whey.

"(3) The system recommended for the preparation of a homemade starter is one which exerts a purifying influence upon the bacterial content of the starter, and results in the elimination of bacteria which are unnecessary if not harmful to the production of a first-class material.

"(4) The use of a whey starter is attended with results equal in every way to those obtained from a milk starter."

A number of precautions to be exercised in the preparation and use of the homemade starter are enumerated. It is noted that "a starter should never be used where without it the cheese can be made in about the time specified [5½ hours];" and that "when a starter is used the whey must be run at an earlier stage." Technique in cheese making is regarded as much more important than the use of pure cultures, "for no amount of bacterium will compensate for a deficiency of that keenness of sense which is the result only of long and patient training."

A handbook of dairying based on science and practice, W. KIRCHNER (*Handbuch der Milchwirtschaft auf wissenschaftlicher und praktischer Grundlage. Berlin: Paul Parey, 4. ed., pp. X + 654, pls. 8, figs. 153*).—A new edition of this book.

Absence of alcohol in the milk from cows fed on distillery malt, M. A. PETERMANN (*Rev. Chim. Analyt. et Appl., 4 (1899), No. 6, pp. 185, 186*).—By the application of the iodoform test to the distillate from a liter of milk, by the Duclaux viscometer test, and by the Westphal balance, the author was unable to detect any alcohol in the milk.—H. SNYDER.

Importance of feeding roots (*Milch Ztg., 28 (1899), No. 26, p. 407*).—A Danish experiment is reported in which the profits were increased by substituting roots for a portion of the concentrated food in rations for milch cows.

Winter milking rations (*Dairy, 11 (1899), No. 127, p. 200*).—Ten rations are suggested as a result of experiments conducted during 3 winters.

Influence of feed on the quantity and quality of the milk, F. C. CURTISS (*Amer. Cheesemaker, 14 (1899), No. 159, pp. 1–3*).

Value of breeds, G. M. GOWELL (*Hoard's Dairyman, 30 (1899), No. 21, pp. 410, 411*).—A popular discussion.

Official tests of Holstein-Friesian cows, S. HOXIE (*Hoard's Dairyman, 30 (1899) Nos. 21, p. 422; 22, pp. 440, 441; 29, p. 580*).—Reports 102 tests made from January 1 to May 1, 1899.

On the source of milk fat, W. A. HENRY (*Breeders' Gaz., 36 (1899), No. 4, pp. 89, 90*).—A discussion of an experiment conducted at the New York State Station (E. S. R., 9, p. 1083).

Swedish ropy milk, G. TROILI-PETERSSON (*Abs. in Milch Ztg., 28 (1899), No. 28, pp. 438, 439*).—The cause of ropiness was investigated and attributed to *Bacterium lactis longi*, which was studied in pure cultures. This germ is considered very closely related to *B. lactis acidi*, from which it is distinguished chiefly by the kind of fermentation produced in milk.

The Babcock test: Its origin, use, and manipulation, A. M. SOULE (*Hoard's Dairyman, 30 (1899), No. 31, pp. 616, 617*).

The Babcock test for cheese factories, J. W. DECKER (*Hoard's Dairyman, 30 (1899), No. 25, p. 488, fig. 1*).—Cheese was made from milk containing 3.3, 4, and 5 per cent of fat, 100 lbs. of milk yielding 10.1, 11.4, and 13.1 lbs. of green cheese, respectively.

Observations on the use of the Kröhnke milk filter, P. VIETH (*Milch Ztg., 28 (1899), No. 26, pp. 403, 404*).—Tests are reported on the use and purification of this filter.

Contribution to the study of butter fat, VAN ENGELEN and P. WAUTERS (*Ind. Lait., 24 (1899), Nos. 29, pp. 229, 230; 30, pp. 237–239*).—From investigations extending through one year the conclusion is drawn that abnormal variations in the composition of butter fat are not due to food or period of lactation.

Preservation of butter, R. Gouin (*Ind. Lait, 24 (1899), No. 34, pp. 269–271*).—Various well-known methods are discussed.

Producing, retaining, and controlling flavor in butter, G. L. McKay (*Hoard's Dairyman, 30 (1899), No. 25, pp. 498, 499*).—A popular article.

A test of churns, C. S. Plumb (*Nat. Farmer and Stock Grower, 2 (1899), No. 2, p. 21*).—Trials were made of a churn provided with inside paddles and an arrangement for revolving them at high speed. On account of the difficulty in removing the butter this type of churn is not to be recommended over standard box and barrel churns without inside devices.

Cheese bacteriology, status of the science in the European countries, H. W. Conn (*Amer. Cheesemaker, 14 (1899), No. 161, pp. 4, 5*).

Cheddar cheese making, J. A. Ruddick (*Amer. Cheesemaker, 14 (1899), No. 163, pp. 1–3*).

Method of manufacturing Stilton cheese, R. Owens [(*Agr. Jour. Cape Good Hope, 14 (1899), No. 12, pp. 785–788*).—The method of manufacture of Stilton cheese is described and compared with that employed in making Cheddar cheese.

The best form of cow stall, P. McConnell (*Jour. British Dairy Farmers' Assoc., 14 (1899), No. 2, pp. 85–90*).

Dairy buildings, R. Henderson (*Trans. Highland and Agr. Soc. Scotland, 5. ser., 11 (1899), pp. 39–115, figs. 11*).

VETERINARY SCIENCE AND PRACTICE.

Thirteenth annual report of the State board of live stock commissioners for the State of Illinois for 1898 (*Springfield, Ill.: Phillips Bros., 1899, pp. 116*).—This report contains a copy of the regulations of the State board of live stock commissioners regarding Texas fever, an account of various outbreaks of Texas fever in the State, and a record of a large number of dipping experiments which were made in connection with the Bureau of Animal Industry of the Department of Agriculture, a part of the results of which have been published elsewhere and are already noted.

The tuberculin test has been applied very generally to the cattle of the State, and extensive tables are given showing the results of tests and post-mortem conditions in cases which reacted.

A report is made upon the cases of actinomycosis discovered by the meat inspectors, and tables are given showing the number of actinomycotic animals coming from the different States.

The report contains a discussion by J. M. Wright of the history and nature of glanders and upon the use of mallein as a therapeutic agent. Tables are also given showing the clinical record of horses which were tested for glanders by means of mallein.

A proposed reform in the nomenclature of veterinary myology, Arloing and Lesbre (*Ann. Soc. Agr. Sci. et Ind. Lyon, 7. ser., 5 (1897), pp. 135–173*).—The authors call attention to the convenience of having a set of names for use in descriptive veterinary anatomy which shall be recognized by all veterinarians. At the meeting of the Sixth International Veterinary Congress in Berne, 1895, a resolution was passed to undertake the preparation of such a veterinary nomenclature. The authors have prepared a list of names of muscles known in veterinary anatomy and these names are arranged in parallel columns with the names of muscles in human anatomy adopted by the congress at Basel, and with other names which have been used to a greater or less extent by various authors, and which are to be regarded as synonymous.

On the biology of anthrax bacillus, R. WEIL (*Arch. Hyg., 35 (1899), No. 3-4, pp. 355-408*).—The results of investigations reported in this article may be summarized as follows: Anthrax bacilli of normal virulence and considerable power of resistance form spores when subjected to moderate temperatures considerably sooner than has usually been assumed. At a temperature of 31 to 37° C. spores were formed within 16 hours, at 24° C. within 36 hours, and at 18° C. within 50 hours. At a temperature of 12° C. the most resistant individuals of the anthrax bacilli are still able to produce resting conditions even when the spore formation does not take place regularly. The spores which are produced at a temperature of 37° C. have a greater power of resistance than those which are formed at temperatures ranging from 18 to 31° C. Anthrax bacilli in their vegetative condition are quickly killed if they are subjected to high temperatures in fluid. Heated in bouillon at 80° C. they are destroyed in 1 minute; at 79°, in 1½ minutes; at 78°, in 2 minutes; at 75°, in 3 minutes; at 70°, in 4 minutes; and at 65°, in 5½ minutes.

If anthrax bacilli are subjected to low temperatures, they are seen to pass through 3 stages. During the first stage the normal virulence may become reduced to so low a grade that mice do not acquire the disease even when inoculated with large quantities of the bacilli. In the second stage they lose the power of growth, but regain this power and their virulence under favorable conditions. In the third stage the bacteria reach such a condition that they can no longer be revived. Atmospheric oxygen has no specific effect upon the formation of the resting stages. The anthrax bacilli form spores under anaerobiotic conditions.

On the excretion of micro-organisms through the active mammary gland, K. BASCH and F. WELEMINSKY (*Arch. Hyg., 35 (1899), No. 3-4, pp. 205-226*).—As experimental animals, the authors made use of guinea pigs. The first bacteria which were used were nonpathogenic and as negative results were obtained, various pathogenic bacteria were next tried.

The living bacteria were injected subcutaneously and by withdrawing small quantities of blood in an aseptic manner it was possible to determine when the bacteria had entered the blood system. The milk from the animal was tested from that time until death. The milk was also injected into healthy animals as a further check upon the experiments. The results obtained may be summarized as follows: The only pathogenic germs which pass out in milk are those that have the power of producing hemorrhages or similar changes in the mammary gland by means of which the normal structure of this gland is disturbed. In a case of pure septicæmic processes, where the blood contains the germs in large numbers, no bacteria were found in the milk even after death, and animals injected with the milk remained entirely healthful. This was true of animals which were inoculated and which died of typhus, diphtheria, cholera, and anthrax. When, however, the animal was inoculated simultaneously with anthrax and *Bacillus bovis morbificans*, hemorrhagic disturbances were produced in the mammary gland and the anthrax bacillus was found in milk.

A case of poisoning, E. F. Ladd (*North Dakota Sta. Bul. 35, pp. 307-310, fig. 1*).—A bull died suddenly with symptoms of poisoning. The stomach contents were analyzed, with the result that conin was discovered. When the owner was questioned concerning his hay, it was found that the hay contained *Cicuta maculata* in abundance. This is, therefore, considered a well-authenticated case of poisoning from water hemlock. A description and illustration of the plant are given and a brief account of the symptoms of poisoning by this plant. The treatment recommended consists in cleansing the alimentary tract and the use of chloroform or chloral, as indicated by the symptoms. It is recommended that these plants be removed from the hay before it is stacked or placed in the barn.

Studies on the seeds and oil cakes of ricinus, C. Cornevin (*Ann. Soc. Agr. Sci. et Ind. Lyon, 7. ser., 5* (*1897*), *pp. 107-133*).—This paper contains a description of the plant and of the appearance of the seeds of the castor-oil plant. The method of extracting the oil is described and an account is given of the extent of the use of the oil cakes, which are left over as by-products, as food for man and domesticated animals. If the cakes are spread upon the ground or exposed to the air for from 5 to 6 days, the poisonous principles are destroyed. If the seeds and cakes are cooked for at least 2 hours, they are no longer poisonous. If a solution of ricin is subjected to heat for 2 hours, of which at least 1¾ hours is up to the boiling point, it is transformed into a vaccine which, when used as a hypodermic or intravenous injection, immunizes the animal against the intoxication of ricinus. After animals have been vaccinated once, they can eat with immunity any quantity of the cakes or seeds of ricinus. The flesh of animals thus immunized is harmless when taken as food.

Researches on the bacterial flora of the lungs of man and animals, L. Beco (*Arch. Méd. Expér. et Anat. Path., Paris, 11* (*1899*), *No. 3, pp. 317-362*).—This paper gives an account of the bacteria ordinarily found in the normal lungs of the guinea pig, rabbit, cat, dog, foal, horse, calf, cow, and sheep. The pathological condition and pathogenic bacteria of the lungs of these animals and of man are also described. In sound lungs the tubercle bacillus was not found.

Bacteria in street dust that is sprinkled and in that which is not sprinkled, T. Mazuschita (*Arch. Hyg., 35* (*1899*), *No. 3-4, pp. 252-282*).—This article contains a record of a large number of observations made with the object of determining the hygienic value of sprinkling streets during hot weather. It was found that when streets were sprinkled the bacteria contained in the dust were more numerous and were in better condition to multiply. The author strongly urges the flooding of streets in summer to wash away the dust in which the bacteria are contained. A bibliography of the subject is added to the article.

A contribution to the knowledge of the infectious diseases of animals and man which are produced by anaërobic bacteria, E. V. HIBLER (*Centbl. Bakt. u. Par., 1. Abt., 25 (1899), No. 15–16, pp. 513–531*).—An extensive account of experimentation with 10 races of bacteria.

Some diseases of domestic animals communicable to man, J. I. GIBSON (*Iowa State Agr. Soc. Rpt. 1898, pp. 94–101*).—The author discusses the common means of transmission of germ diseases. The following diseases are described and an account given of the means and extent of their transmission to man: Actinomycosis, blackleg, glanders and farcy, hog cholera, and tuberculosis.

Practical notes on influenza, P. P. SANCHEZ (*Vet. Españ., Madrid, 42 (1899), Nos. 1493, pp. 145–149; 1494, pp. 161–166; 1495, pp. 178–183*).—Gives a description of the disease, a differential diagnosis of influenza and contagious pleuro-pneumonia. An account is given of inoculation experiments for rendering immunity and of hydrotherapy in the treatment of the disease.

Two cases of tetanus cured by the use of antitetanus serum, L. CONSTANT (*Jour. Med. Vet. et Zootech., 5. ser., 3 (1899), pp. 340, 341*).—Clinical records and description of method of using the antitoxin.

On the modifications of tetanus poison, E. BEHRING (*Fortschr. Med., 17 (1899), No. 21, pp. 501–505*).—For producing immunity against tetanus, poisons with a high multiple of indirect poison value in comparison with their direct poison value give better results than the equilibrated poisons.

Antitetanus serum and its preparation, L. S. VIZMANOS (*Vet. Españ., Madrid, 42 (1899), Nos. 1499, pp. 241–244; 1500, pp. 257–260; 1501, pp. 279–281*).—A general account of the effect of antitetanus serum when used for the prevention of tetanic contractions, and a description of the method of preparation.

On the quantitative combination relations between tetanus toxin and tetanus antitoxin in living guinea pigs, E. BEHRING (*Fortschr. Med., 17 (1899), No. 22, pp. 521–534*).—This paper contains a record of a large number of experiments upon guinea pigs and a discussion of the nature and quantitative relationship of the chemical union between the toxin and antitoxin.

Zahn's thermometer holder, J. G. VAETH (*Deut. Tierärztl. Wchnschr., 7 (1899), No. 26, pp. 234, 235, fig. 1*).—A new arrangement for holding the thermometer during tuberculin tests.

Anthrax (*Rev. Facult. Agron. y Vet., La Plata, 4 (1899), No. 1, pp. 129–131*).—Discusses the nature of the disease, the value of vaccination, and the burial of carcasses.

Blackleg vaccine, E. P. NILES (*South. Planter, 60 (1899), No. 7, pp. 335–337, figs. 2*).—The Virginia Station has equipped itself for making blackleg vaccine. Directions are given for sterilizing the hypodermic syringe and making the injections. A list of questions is added which will be sent to each farmer who uses the vaccine.

Actinomycosis in Spain, L. DEL RIO (*Vet. Españ., Madrid, 42 (1899), No. 1497, pp. 210–212*).

The so-called actinomycosis musculorum suis, DAVIDS (*Ztschr. Fleisch u. Milchhyg., 9 (1899), No. 10, pp. 181–187*).—Gives an historical account of the subject and descriptions of appearances of the disease from paraffin sections.

Milk fever in the cow, M. IMES (*Agr. Student, 5 (1898), No. 3, pp. 57, 58*).—A description of the symptoms of the disease is given, together with an account of its etiology and preventive measures, such as antiseptic washes.

On the Schmid-Kolding treatment of milk fever, BRÜLLER (*Wchnschr. Tierheilk. u. Viehzucht, 43 (1899), No. 26, pp. 245, 246*).—Gives a clinical record of 4 cases.

Milk fistula, P. LEBLANC (*Jour. Med. Vet. et Zootech., 5. ser., 3 (1899), pp. 332–334*).—An abscess followed by erysipelas of the mammary gland in a goat left a milk fistula which healed after being ligatured.

Concerning contagious vaginitis of cows, A. LUCET (*Jour. Med. Vet. et Zootech, 5. ser., 3 (1899), pp. 338, 339*).—A discussion of the cause and communicability of the disease.

Distomatosis of the abdominal walls of the cow, REPIQUET (*Jour. Med. Vet. et Zootech, 5. ser., 3 (1899), pp. 271, 272*).—Tubercles formed by distomum are distinguished from those of tuberculosis in similar positions.

Preventive inoculation against red water or tick fever, D. HUTCHEON (*Agr. Jour. Cape Good Hope, 11 (1899), No. 7, pp. 415–418*).—Young heifers were injected with defibrinated blood from animals which had recovered from the disease. After they had in turn recovered, which was usually about 6 weeks later, their blood was used for inoculation purposes to produce a mild form of disease.

Preliminary note on bovine malaria, NICOLLE and ADIL-BEY (*Ann. Inst. Pasteur, 13 (1899), No. 4, pp. 337–343*).—The native races of cattle are perfectly immune and can withstand injections of large quantities, even liters of virulent blood. The serum from cattle thus treated, if collected from 2 to 6 weeks after these inoculations, has no preventive or curative power.

Experimental data on the subject of the susceptibility of camels to cattle plague, M. TARTAKOVSKY (*Arch. Vet. Nauk, St. Petersburg, 29 (1899), No. 4, pp. 228–251*).—The article contains records of experimental inoculations of camels accompanied with temperature charts.

A new parasitic disease of cattle in Cochin China (Amphistomosis hepatica) (*Vet. Jour., 48 (1899), No. 287, pp. 347–350*).—*Amphistomum hepaticum* was found in oxen of Cambodia, Indian buffaloes, and zebus. The anatomical characters of the fluke and the pathological conditions caused by it are described.

How an attack of epizootic abortion was dealt with, C. MARSHALL (*Jour. British Dairy Farmers' Assoc., 11 (1899), No. 2, pp. 91, 92*).—Nocard's method of treatment was tried with good results.

The epizootic occurrence of Tænia cœnura in the calf, T. TAVALLAZZI (*Giorn. R. Soc. Accad. Naz. Vet. Ital., 48 (1899), No. 26, pp. 612–615*).

Railroad fever of cows, ESTOR (*Deut. Tierärztl. Wchnschr., 7 (1899), No. 26, pp. 233, 234*).—Outlines the symptoms of this disease, which is frequently observed in cattle after long railroad journeys. The remedies which have been tried are bloodletting, keeping quiet (with chloral hydrate if necessary), strychnin, alcohol, atropin, and potassic iodid. No treatment, however, had much effect except in mild cases.

Water on the joints in cattle, CADÉAC and MOROT (*Jour. Med. Vet. et Zootech., 5. ser., 3 (1899), pp. 202–205, figs. 2*).—Gives a description of the pathological anatomy of the metatarsus from an animal affected with this disease. The appearance is compared with that of ergotism.

On the physiological effect of digitalis and its diagnostic importance in pericarditis traumatica of cattle, GMELIN (*Monatsh. Prakt. Thierh., 10 (1899), No. 9, pp. 385–417, figs. 33*).—In cases of this disease digitalis is found to have great value as a diagnostic agent. As a remedy it is not uniform in action. A number of sphygmographic tracings of blood pressures in the carotid artery accompany the article.

Bovine rumenotomy, S. H. SWAIN (*Jour. Comp. Med. and Vet. Arch., 20 (1899), No. 4, pp. 223–225*).—The article contains an account of the method of preparing the instruments and animals and of making the operation.

On the causes of the sterility of cattle, E. ZSCHOKKE (*Landw. Jahrb. Schweiz, 12 (1898), pp. 252–272, pl. 1*).—Contains a general discussion and classification of the various causes of sterility, whether from pathological anatomy and physiology or from peculiarities of temperament and constitution of both sexes.

On multiple adenom formation in the lungs of sheep, A. EBER (*Ztschr. Tiermed., 3 (1899), No. 3, pp. 161–172, pls. 4*).—These formations are described and figured with especial reference to their microscopic details. The etiology of the disease is not thoroughly known.

Remarks on the nature and the differentiation of the infectious swine diseases in the United States, V. A. Moore (*Amer. Vet. Rev., 21 (1898), No. 12, pp. 813-829*).—The author here gives an historical account of the development of our knowledge on the subject of hog cholera and swine plague. A synonymy of names is added for this country and Europe, and detailed descriptions of the pathological anatomy of hog cholera and swine plague are given, as well as a list of the characters of the bacilli of these two diseases.

Hog cholera and swine plague, A. W. Bitting (*Reprinted from Farmer's Guide, 1898, Aug.-Oct., pp. 22*).—In this pamphlet are discussed the extent of the swine industry in Indiana and the various questions connected with the diagnosis and treatment of hog cholera and swine plague. The author has made an experimental study of a large number of patent remedies which have been recommended for treatment of swine diseases and concludes that they are all worthless. Stress is laid upon the advisability of maintaining cleanly surroundings as a means of preventing serious outbreaks of swine diseases.

Serum therapy of hog cholera, E. Leclainche (*Ann. Méd. Vét., 48 (1899), No. 7, pp. 367-370*).—A brief discussion of the method to be adopted in preparing the hog-cholera serum and of the technique of its application.

Practicability of serum therapy in the treatment of hog cholera, W. B. Niles (*Iowa State Agr. Soc. Rpt. 1898, pp. 315-318*).—In this paper the author discusses the technique of the application of the serum treatment for hog cholera and gives a brief account of the success which has attended its use.

Results of some vaccinations with Beck's serum against swine diseases, J. Müller (*Deut. Tierärztl. Wchnschr., 7 (1899), No. 26, pp. 235, 236*).—Reports the favorable outcome from vaccination of sows.

Infectious pneumoenteritis of the pig (*Gaz. Méd. Vét., 3. ser., 23 (1899), No. 137, pp. 543-547*).—Gives the history of our knowledge of the disease and a discussion of its cause, distinguishing between hog cholera and swine plague.

The serotherapy of erysipelas of the pig, E. Leclainche (*Compt. Rend. Soc. Biol., Paris, 11. ser., 1 (1899), No. 15, pp. 346-348*).—Inoculations were made with a mixture of immunizing serum and virulent cultures of blood. Sheep proved to be good animals from which to obtain immunizing serum.

Combating erysipelas of hogs, O. Voges and W. Schütz (*Deut. Tierärztl. Wchnschr., 7 (1899), No. 20, pp. 177-179*).—A serum is used which destroys the bacillus when injected into animals already suffering from the disease and also has the power of giving immunity.

Echinococcus veterinorum, S. Stewart (*Jour. Comp. Med. and Vet. Arch., 20 (1899), No. 4, pp. 215-217*).—In the region of Kansas City, Missouri, it is stated that about 5 out of every 1,000 hogs are infected with the cystic stage of *Echinococcus veterinorum*. A description is given of the post-mortem appearance of the disease.

Projection as a reliable means for demonstrating the presence of trichinæ, H. Kabitz (*Ztschr. Fleisch u. Milchhyg., 9 (1899), No. 10, pp. 187-189*).—Description of a projection apparatus for examining flesh for trichinæ. The instrument is known as a trichinoscope.

A case of malarial fever, H. Taylor (*Vet. Jour., 49 (1899), No. 289, pp. 1-8, figs. 3*).—Gives the symptoms of the disease in a horse. Treatment with potassic nitrate, potassic chlorate, quinin, and iron tonics was of no avail. Post-mortem lesions and microscopic appearances of tissues are described.

The etiology and pathology of endocarditis, Thomassen (*Ann. Med. Vet., 48, (1899), No. 6, pp. 285-29[illegible]*).—A microscopic examination of sections from the sigmoid and mitral valves from the heart of a mare which died of the disease disclosed the presence of streptococci and bacilli.

An experiment in inoculating camels with glanders, E. T. Dshunkovsky (*Arch. Vet. Nauk, St. Petersburg, 29 (1899), No. 4, pp. 255-261*).—A record of experimental inoculations of camels with this disease.

The pathology and treatment of spavin, J. MACQUEEN (*Jour. Comp. Path. and Ther., 12 (1899), No. 2, pp. 119–125*).—The author discusses the anatomical conditions found in cases of spavin and gives a general discussion of the cause of this disease.

Some "inventors'" horseshoes, J. A. W. DOLLAR (*Veterinarian, 72 (1899), No. 859, pp. 479–487, figs. 9*).—A discussion with illustrations of some of the numerous inventions in the line of nailless horseshoes.

Diseases of poultry, G. E. HOWARD (*The American Fancier's Poultry Book. Washington, D. C.: G. E. Howard & Co., 1898, pp. 89–102, ill.*).—The author gives a discussion of the symptoms and treatment for all of the more common diseases of poultry, including apoplexy, black rot, bumblefoot, canker, catarrh, cholera, consumption, crop bound, diarrhea, egg bound, egg eating, feather eating, frost bites, gapes, giddiness, gout, indigestion, leg weakness, lice, liver diseases, pip, rheumatism, roup, scaly legs, soft eggs, ulceration, and worms. Figures are given of the more common forms of parasitic insects which attack poultry.

The tick of the domestic fowl and fowl fever (*Bot. Dept. Trinidad Bul. Misc. Inform., 3 (1899), No. 19, pt. 11, p. 180*).—*Argas americanus* is said to have been introduced into Trinidad, and to be the cause of a fowl fever in that place.

A disease in cattle not distinguishable from rabies, V. A. MOORE (*Veterinarian, 72 (1899), No. 858, pp. 396–416*).—Contains a clinical record and account of post-mortem conditions of cattle which died of a disease closely simulating rabies. Inoculation upon rabbits with virulent cultures gave positive results. The rabbits died with all the symptoms of ordinary rabies. The author concludes that rabies may occur without being traceable to the bites of mad dogs, and recommends that when the disease breaks out the cattle should be removed to higher ground.

On the narcosis of domesticated animals, FRICK (*Deut. Tierärztl. Wchnschr., 7 (1899), No. 25, pp. 225–227*).—A discussion of the relative merits of chloroform, morphin, chloral hydrate, ether, and cocain. The different methods of application are described, and special discussions are given on the choice of the most suitable narcotic for the horse, ox, pig, dog, and cat.

The occurrence of cancer in the lower animals, J. MACFADYEAN (*Jour. Comp. Path. and Ther., 12 (1899), No. 2, pp. 137–141*).—Carcinomata are recorded in the form of primary or secondary tumors in the dog, cat, horse, cow, and sheep.

Discovery of Bacillus alvei, L. STACHELHAUSEN (*Southland Queen, 5 (1899), No. 1, pp. 8–10*).—A history of the work which led to the discovery of the germ, and brief mention of remedies.

Contagious pustulant dermatitis, TRASBOT (*Rec. Méd. Vét., Paris, 8. ser., 6 (1899), No. 8, pp. 163–172*).—Gives a statement of the symptoms and clinical appearance of this disease, which has been called Canadian variola and American variola.

The necrosis bacillus as a cause of disease in our domesticated animals, FRANCKE (*Berlin. Tierärztl. Wchnschr., 1899, No. 25, pp. 299–303*).—An historical discussion of the development of our knowledge of the bacillus and of its activity during the acute stages of certain diseases.

A septicæmia of the guinea pig, C. PHISALIX (*Bul. Mus. Hist. Nat. [Paris], 1898, No. 6, pp. 279–282*).—Gives an outline of culture methods, and a description of the bacillus and of its pathogenic action. The dog resists the action of this bacillus, but rabbits, mice, and pigeons succumb quickly.

Psittacosis, or parrot septicæmia, L. BRUSASCO (*Giorn. R. Accad. Naz. Vet., 48 (1899), No. 19, pp. 434–441*).—Notes on a contagious disease which is said to be frequent among parrots imported from America, and which can be easily transmitted to man.

Contribution to the study of Laverania danylewsky, A. LAVERAN (*Compt. Rend. Soc. Biol., Paris, 11. ser., 1 (1899), No. 24, pp. 603–606, figs. 12*).—This organism is an endoglobular hematozoon which infests pigeons. The author suggests that certain species of mosquitoes probably serve as intermediate host for the hematozoa.

Preventive inoculation, W. M. HAFFKINE (*Jour. Comp. Path. and Ther., 12 (1899), No. 2, pp. 142–156; reprinted from The Lancet*).—This article is in the nature of a general discussion covering the derivations from virus and microbes and their effect, immunity against the attack and resistance against actual symptoms of diseases, the relationship between the two, and records concerning inoculations made as prophylactic remedies against the plague.

The intensification of virulence in sera taken from overimmunized animals, H. VALLÉE (*Compt. Rend. Soc. Biol. Paris, 11. ser., 1 (1899), No. 18, pp. 432, 433*).—There is no bactericide action in the sera of overimmunized animals.

A contribution to the knowledge of sera which have a specific effect upon blood corpuscles, K. LANDSTEINER (*Centbl. Bakt. u. Par., 1. Abt., 25 (1899), No. 15-16, pp. 546-549*).—The agglutination of blood corpuscles by specific sera is to be considered due to the action of the stroma of the red blood corpuscles.

TECHNOLOGY.

Experiments in sirup making, B. B. ROSS (*Alabama College Sta. Bul. 103, pp. 97-105*).—An account is given of experiments in the clarification and manufacture of sirup on a small scale, in continuation and extension of work previously reported (E. S. R., 7, p. 719). It appears that the best results in clarification and evaporation are secured by the use of steam for heating purposes.

"Since the evaporation of juices and sirups is carried out in the sugar factories and refineries upon such a large scale, it was impossible to secure upon the market evaporation apparatus adapted to sirup making upon a small scale, and hence two small evaporators were especially constructed for experimental purposes, the smaller of the two being improvised from an ordinary open-fire evaporator already on hand.

"This evaporator was about 4½ ft. long, 3 ft. wide, and about 6 in. deep, while the large evaporator had a length of about 5 ft , a width of about 3 ft., and a depth of 10 in.

"The sides of the evaporators were of wood as usual, and the bottoms were constructed of sheet copper, but no partitions were employed as in the ordinary evaporators.

"A series of pipes, connected at the ends by return bends, were placed in the bottom of each evaporator, almost the whole surface of the bottom being thus covered, with the exception of a space about 4 or 5 in. in width which was reserved for the collection of the scums from the boiling juice. This unoccupied space should be on the side of the evaporator opposite to the point at which the steam is admitted, and this side should also be slightly lower than the other in order to facilitate the removal of the scums. The piping employed was galvanized iron, three-fourths inch inside diameter, and valves were provided for the proper regulation of the steam used in the evaporation, while another set of valves enabled the operator to prevent the too rapid escape of waste steam from the coil.

"The juice, after sulphuring, is first run into the small evaporator or clarifier, steam is turned on, and the contents of the clarifier brought gradually to a boil.

"The scums and impurities come to the surface quite rapidly, the greater portion of them collecting over the space not occupied by the pipes, where they can be easily removed.

"The clarifier is somewhat more elevated than the evaporator, and when the juice has been well skimmed it is at once run into the larger evaporator and the steam is immediately turned on.

"Fresh quantities of juice are now run into the clarifier, boiled, skimmed, and then run into the evaporator, the evaporation of the juice being conducted all the while.

"Any scums which form in the evaporator can be removed in the usual way, and when the sirup has reached the proper density, the steam is shut off and the evaporator is emptied through the usual outlet."

The process of clarifying by means of sulphur fumes with or without lime, described in an earlier bulletin, has continued to give excellent results.

"When this process is employed, the resulting sirup is much clearer and brighter, and at the same time, it can be preserved much more readily. If it is desired to preserve the sirup for a considerable period of time, the hot liquid, concentrated to the proper strength, is run into a bottle or a well-glazed jug of from ½ gal. to 1 gal. capacity, which has been rinsed out with hot water. The vessel is filled almost up to the mouth with the hot sirup and is then securely sealed and stored away for future use.

"By this process sirup has been successfully preserved at the laboratory for from 1 to 4 years, and crystallization of sugar can also be prevented if care is taken to avoid cooking the sirup to too great a density."

"Clariphos" (a strong solution of acid phosphate of lime) and bisulphite of lime were also tested as clarifying agents. The former is considered valuable for the purpose, especially in sugar houses, "but the increased amount of manipulation required in the way of settling, filtering, etc., interferes materially with its adaptability to sirup making upon a small scale. . . .

"It is believed that under normal conditions the bisulphite can be used to advantage as a substitute for sulphurous-acid gas."

The manufacture of sorghum sirup, A. A. DENTON (*U. S. Dept. Agr., Farmers' Bul. 90, pp. 32, figs. 9*).—In this bulletin "the simplest means only, suited to sirup makers who have limited facilities, are considered." It is stated that the manufacture of sorghum sirup has declined because of the inferior quality of the product. It is claimed that by selecting varieties of sorghum suited to sirup making, employing methods of planting and cultivation favoring the full development of the canes, and by more efficiently clarifying the juice, sorghum sirup can be produced of as good quality as sugar-cane sirup.

"The quality of sorghum sirup is determined by the more or less perfect separation from the juice of the impurities which are solid and of those which are in solution." The removal of the former only is considered in the bulletin.

"The methods recommended are cold settling of raw clayed juice, with or without lime, or settling the heated juice with clay, and with or without lime. The method preferred is to settle cold, limed and clayed juice, draw off and heat the settled juice, clay and settle it, and again draw it off, then evaporate it."

The removal of the soluble impurities is to be further investigated before recommendations are made.

Is maize stored for a long time suitable for the manufacture of starch? (*Ztschr. Spiritusind., 22 (1899), p. 37; abs. in Jour. Soc. Chem. Ind., 18 (1899), No. 3, p. 288*).—Old maize, if stored when thoroughly ripe, is considered as a rule preferable to fresh maize for starch making, because it is drier and yields more starch.

Report of the enological station of Haro, Spain (*Mem. An. Estac. Enol. Haro, 1898, pp. 42*).—This is one of the enological stations established by the royal decree of February 15, 1892. The work reported consists principally of meteorological observations and chemical examinations with reference to the growth of grapes and the production of wine.

How to produce good wine, E. MAUMENÉ (*Comment s'obtient le bon vin. Paris: Société D'Éditions Scientifiques, 1898, pp. 238, figs. 51.*)—This manual is volume 3 in the series Encyclopédie des connaissances pratiques. It is designed to be a ready reference book for wine manufacturers, and as such the practical aspect of the subject is kept always in view. After an introductory chapter on certain physiological processes in the grape, the author discusses alcoholic fermentation, various methods and processes of manufacture, qualities of wine and the ways they may be affected, adulterations, both admissible and inadmissible, and analyses of musts and wines. The book has a complete table of contents, but no index.

Wine making based upon the properties of grape oxydase, A. BOUFFARD and L. SEMICHON (*Ann. École Nat. Agr. Montpellier, 10 (1898), pp. 37–89, figs. 2*).—The authors claim that by the proper use of oxydase and a little sulphuric acid almost any color of wine may be produced. Under some conditions oxydase may prove injurious to wine making.

Recent progress in vinification, A. LOIR (*Rev. Sci., 4. ser., 11 (1899), No. 17, pp. 526–529*).

Washing cider apples, TRUELLE (*Mess. Agr., 4. ser., 10 (1899), No. 5, p. 164*).—If a lot of cider apples are washed and the water filtered, an ill-smelling filtrate is often obtained. This residue would have given a bad taste to cider. In washing, the fruit loses some pectins, a little sugar, traces of tannin, and some of its ferments; hence cider from washed fruits ferments slowly at first, but the rapidity of fermentation accelerates under favorable conditions. It is recommended that baskets of fruit be placed in a stream of water and then be allowed to dry before pressing. The process is much used in Germany, Austria, and Switzerland.

Cost of construction and operation of cotton-seed oil mills; value and uses of oil, meal, and hulls, B. W. KILGORE (*Tradesman, 41 (1899), No. 8, pp. 55, 56*).

Oil seeds and cotton oil, WAGNER (*L'Engrais, 14 (1899), No. 9, pp. 208–210*).

AGRICULTURAL ENGINEERING.

The construction of a stave silo, L. A. CLINTON (*New York Cornell Sta. Bul. 167, pp. 173–188, figs. 7*).—After three years' study and observation the author concludes that the round stave silo "is the most practical and successful silo which can be constructed." The original cost is very slight, as no expert labor is required, and the maximum of capacity is secured with the minimum of material. The bulletin gives a detailed explanation of the construction of a stave silo, based largely upon experience with such a silo built at the station in 1898.

Irrigation in Colorado, J. SHOMAKER (*Irrig. Age, 13 (1899), No. 1, pp. 7–10*).—A brief review of history and present status.

Irrigation in Wyoming, J. SHOMAKER (*Irrig. Age, 13 (1899), No. 2, pp. 41–44*).—A brief review of history and present status.

Market garden irrigation (*Amer. Agr. (mid. ed.), 63 (1899), No. 24, pp. 747, 748*).

Usefulness of reservoirs to agriculture in the irrigated regions, E. MEAD (*Senate Doc. 124, 55. Congress, 3. Session, pp. 14, figs. 2*).—A brief discussion of the subject submitted in response to a resolution of the Senate of the United States.

Unprofitable irrigation works, T. S. VAN DYKE (*Irrig. Age, 13 (1899), Nos. 1, pp. 11–16; 2, pp. 44–50*).—These are the fifth and sixth papers of this series.

Water rights according to the explanations of the civil department of Cassation of the Senate, D. FLEXOR (*St. Petersburg: Min. of Agr. and Imp. Domains, Div. of Land Amelioration, 189–, 2. ed., pp. XII + 151*).

Agricultural machinery in Denmark, 1898, C. V. BIRK (*Tidsskr. Landökon., 1899, No. 4, pp. 223–232*).

Third annual report of the Provincial Instructor in Roadmaking, Ontario, 1898, A. W. CAMPBELL (*Pp. 80, figs. 13*).—Brief notes on a variety of topics.

A cow barn with framework of steel (*Irrig. Age, 13 (1899), No. 2, pp. 64–68, figs. 6*).—An illustrated description of a barn built on the grounds of the Hospital for the Insane at Middletown, Connecticut.

Dairy buildings, R. HENDERSON (*Trans. Highland and Agr. Soc. Scotland, 5. ser., 11 (1899), pp. 39-115, figs. 41*).—This article discusses in considerable detail, with numerous illustrations, the arrangement, plan, materials, and construction of cow stables, milk houses, churning rooms, cheese rooms, dairy offices, pig and poultry houses, manure pits, sculleries, etc. Special attention is given to the question of ventilation.

A barn for cattle feeding, J. E. WING (*Breeders' Gaz., 35 (1899), No. 15, p. 451, figs. 2*).

The new poultry house and other buildings at the New York State Station (*New York State Sta. Bul. 153, pp. 316-319, figs. 4*).—Brief illustrated descriptions are given of a poultry house, piggery, and manure shed.

STATISTICS—MISCELLANEOUS.

Thirteenth Annual Report of Alabama Canebrake Station, 1898 (*Alabama Canebrake Sta. Rpt. 1898, pp. 16*).—Brief notes are given on tests of field crops and vegetables, noted elsewhere, and on insecticides and fungicides, together with a financial statement for the year ending December 31, 1898.

Ninth Annual Report of Arizona Station, 1898 (*Arizona Sta. Rpt. 1898, pp. 151-189*).—This includes the treasurer's report for the fiscal year ending June 30, 1898; a report of the acting director on the personnel, equipment, work of the station, and station publications, and reports of the botanist, chemist, and agriculturist and horticulturist, noted elsewhere.

Eleventh Annual Report of Arkansas Station, 1898 (*Arkansas Sta. Rpt. 1898, pp. 100*).—A financial statement for the fiscal year ending June 30, 1898, with a brief report by the director and reprints of Bulletins 19-55 of the station on the following subjects: Preliminary report on Arkansas seedling apples (E. S. R., 10, p. 48); second-crop potatoes for seed (E. S. R., 10, p. 542); methods of combating communicable diseases of farm animals (E. S. R, 10, p. 595); the feeding value of whole cotton seed, crushed cotton seed, and cotton-seed meal and hulls for finishing steers for market (E. S. R., 10, p. 673); a report of progress of investigations in the chemistry of wheat (E. S. R., 10, p. 943); fattening value of certain foods gathered by pigs (E. S. R., 10, pp. 1085, 1089); orchard cultivation (E. S. R., 10, p. 1044).

Eleventh Annual Report of Louisiana Stations, 1898 (*Louisiana Stas. Rpt. 1898, pp. 8*).—This contains a report of the director on the work of the Sugar Station at Audubon Park, the State Station at Baton Rouge, and the North Louisiana Station at Calhoun; the staff of each station; a subject list of bulletins issued during the year, and a financial report for the fiscal year ending June 30, 1898.

Eleventh Annual Report of Maryland Station, 1898 (*Maryland Sta. Rpt. 1898, pp. 169-176*).—This contains a brief outline of the work of each department, a list of the publications issued during the year, notes on the station staff, a meteorological summary for 1897, and a report of the treasurer for the fiscal year ending June 30, 1898.

Fourth Annual Report of Montana Station, 1897 (*Montana Sta. Bul. 16, pp. 53-100, figs. 2, dgm. 1*).—Contains a financial statement for the fiscal year ending June 30, 1897, and reports by the director, horticulturist, chemist, biologist, and agriculturist. The report of the horticulturist is noted elsewhere, and that of the chemist contains an illustrated description of the new chemical building erected at the station.

Director's report for 1898, W. H. JORDAN (*New York State Sta. Bul. 153, pp. 303-332, pls. 12, dgms. 4*).—This includes brief notes on the personnel of the station; descriptions of the new biological and dairy building (E. S. R., 10, p. 401) and the new poultry house (see above), and notes on other building improvements; a discussion of the relation of the station staff to farmers' institute work; a review of the work of the departments of chemistry, horticulture, botany, entomology, and animal industry for the year; and a subject list of Bulletins 143-157 published in 1898.

Proceedings of Agricultural Students' Association, 1898-99 (*Nebraska Sta. Bul. 57, pp. 27-56*).—The constitution and by-laws of the association and the minutes of the first annual meeting held March 10, 1898, are given. Experiments with smooth brome grass are noted elsewhere. Plans for future work in agriculture, botany, entomology, horticulture, etc., are suggested.

Experiment Station Work—IX (*U. S. Dept. Agr., Farmers' Bul. 92, pp. 30*).—The following subjects are treated in this number: Sugar beets on alkali soils, planting and replanting corn, improvement of sorghum, improved culture of potatoes, second-crop potatoes for seed, cold *vs.* warm water for plants, forcing head lettuce, the date palm in the United States, the codling moth, Jerusalem artichokes for pigs, feeding calves, pasteurization in butter making, gassy and tainted curds, and pure cultures in cheese making.

The past and future of Scottish agriculture, A. HUTCHESON (*Trans. Highland and Agr. Soc. Scotland, 5. ser., 11 (1899), pp. 121-149*).

Bulletins of Alabama Station (*Index to Vol. VI, Buls. 89-100*).

Wisconsin farmers' institutes, 1898 (*Wisconsin Farmers' Institutes Bul. 12, pp. 270, figs. 76*).—This is a report of the twelfth annual closing farmers' institute held at Janesville, March 8, 9, and 10, 1898, and includes some 37 popular addresses, with discussions.

Address and report read at the annual meeting of the Moscow Agricultural Institute September 26, 1898 (*Moscow, 1898, pp. 136; abs. in Selsk. Khoz. i Lyesov., 192 (1899), Mar., pp. 709, 710*).—There were in the institute at the close of the academic year 1896-97 182 students. Of this number 44 graduated. The cost of maintenance of the institute in that year amounted to 186,000 rubles (about $74,000).—P. FIREMAN.

Agricultural returns for Great Britain for 1898, P. G. CRAIGIE (*London: Wymen & Sons, 1899, pp. LIV+267*).—This report shows the acreage and produce of crops, prices of grain, and number of live stock, with agricultural statistics for the United Kingdom, British possessions, and foreign countries.

Agricultural conditions in the Russian Baltic Provinces, L. FRIIS (*Tidsskr. Landökon., 1899, No. 3-4, pp. 164-194*).

Our foreign trade in agricultural products, F. H. HITCHCOCK (*U. S. Dept. Agr., Section of Foreign Markets Bul. 15, pp. 45*).—A statistical review of the agricultural imports and exports of the United States during the five fiscal years 1894-1898. In 1898 the agricultural imports amounted to $314,291,796, which was over 51 per cent of the total imports, and the agricultural exports to $858,507,942, or about 71 per cent of the total exports. Among the exports showing an increase in 1898 were wheat, corn, oats, rye, bacon, lard, hams, pickled pork, cotton-seed oil, oil cake and oil-cake meal, cattle, and horses, and among those showing a decrease were leaf tobacco, barley, canned beef, salted or pickled beef, hides and skins, and butter. Of the imports coffee, hides and skins, silk, and vegetable fibers showed an increase in 1898, and sugar, wool, tea, leaf tobacco, fruits, wines, vegetable oils, spices, and distilled spirits showed a decrease.

Agricultural imports and exports, 1894-1898, F. H. HITCHCOCK (*U. S. Dept. Agr., Section of Foreign Markets Circ. 21, pp. 15*).—Statistical tables reprinted from Bulletin 15 of the Section, noted above.

The sugar industry and its requirements, E. DENMAN (*Queensland Agr. Jour., 5 (1899), No. 2, pp. 110-116*).—Paper read by the author before an agricultural conference, dealing with the sugar industry of Queensland and in other sugar-producing countries of the world.

The work of the Imperial Russian Society for the acclimatization of animals and plants, N. F. ZOLOTNITSKY (*Moscow: Min. Agr. and Imperial Domains, 1899, vol. 7, pt. 1, pp. 192; abs. in Selsk. Khoz. i Lyesov., 193 (1899), pp. 713, 714*).

Proceedings of the Portuguese Royal and Central Agricultural Association, 1897-98 (*Travoux executés de 1897-98 par l'association royale et centrale d'agriculture portugaise. Lisbon: Typographie Portugaise, 1899, pp. 111*).

NOTES.

Alabama College Station.—W. B. Frazer has recently been added to the station staff as assistant in horticulture, and A. McB. Ransom has been elected third assistant chemist. The new chemical laboratory, designed exclusively for research work, is rapidly nearing completion. It is a commodious brick structure with stone trimmings, containing one story and basement. It is well lighted and ventilated, and will be furnished with all the appliances of a well-ordered laboratory. As soon as it is completed it will be occupied as the experiment station laboratory, while the older building will be given over exclusively to college work.

Connecticut College.—The name of this institution has been changed from Storrs Agricultural College to The Connecticut Agricultural College.

Connecticut State Station.—A. L. Winton, after 15 years of continuous service, has been given 6 months' leave of absence, which he will spend in travel and study in Europe. W. L. Mitchell has resigned to take a position as chemist in a manufacturing establishment, and Clifford Langley, a graduate of Yale University, has been added to the staff as assistant chemist.

Illinois Station.—The station has recently made an extensive exhibit at the Decatur Corn Carnival of experiments in Indian corn, which attracted much attention and brought the work of the station prominently before a large number of people.

Iowa College and Station.—H. H. Hume, formerly assistant in the departments of botany and horticulture at the station, has recently been elected horticulturist and botanist in the Florida College and Station. C. R. Ball, formerly assistant in botany at the college and station, has been made third assistant in the Division of Agrostology of the U. S. Department of Agriculture.

Kansas Station.—R. B. Mitchell, assistant in the veterinary department of the station, has resigned to accept an appointment in the U. S. Army.

Maryland College and Station.—F. P. Vietch, M. S., has been appointed assistant soil physicist, and will work with Professor Whitney, in Washington, D. C.; Thomas M. Price, a graduate of the college, has been appointed assistant chemist, and H. P. Gould has been appointed assistant entomologist to succeed E. D. Sanderson, resigned. W. T. L. Taliaferro, professor of agriculture in the college, will be connected with the station in the capacity of agriculturist, and C. F. Doane, assistant in dairying and bacteriology at the station, will serve in the college as instructor in dairying during the coming year.

Nebraska University and Station.—R. S. Hiltner, assistant chemist of the station, has resigned to accept a position in the department of chemistry of the university, and R. W. Thatcher has been appointed to fill the vacancy on the station staff. E. A. Burnett, formerly in charge of animal husbandry in the South Dakota College and Station, has been appointed to a similar position in this university and station.

New Hampshire Station.—Arthur Given has resigned his position as assistant chemist, and Roscoe H. Shaw, B. S., and Harry A. Clark, B. S., have been appointed assistant chemists. E. H. Forristall has resigned as assistant in agriculture to become superintendent of the farm and herd of the Walker Gordon Company, of Boston, Mass. He has been succeeded by H. P. Richardson, B. S.

New Jersey Stations.—John B. Williams, of New Durham, has been appointed a member of the governing board, *vice* Abraham W. Duryee, deceased.

New Mexico Station.—P. Moreno, of Las Cruces, and L. Bradford Prince, of Espanola, have been appointed members of the governing board, *vice* J. Armijo, deceased, and H. D. Bowman, resigned. C. H. Tyler Townsend has retired from the station staff. A series of weekly press bulletins prepared by the agricultural and horticultural department are being widely distributed throughout the Territory and seem to be much appreciated.

North Carolina College and Station.—J. A. Bizzell, assistant chemist, has retired from the station work and will devote his whole time to teaching. B. S. Skinner, farm superintendent, has also retired from station work.

North Dakota Station.—W. C. Langdon has resigned his position as veterinarian of the station. His successor has not yet been appointed.

Pennsylvania Station.—M. E. McDonnell, who recently returned from Europe, where he had pursued a course in dairy bacteriology, and was appointed assistant bacteriologist in the college and station, has resigned to become bacteriologist to the Pennsylvania Railroad Company, with headquarters at Altoona. J. D. Huston, fellow in dairy husbandry; W. A. Hutchison, fellow in agricultural chemistry, and A. O. Hiester, special assistant, are no longer connected with the station.

Rhode Island College.—The prospectus for the second special winter course of study and training in poultry culture has been issued. The course occupies six weeks and will commence January 10, 1900.

South Carolina College and Station.—C. C. Newman has been appointed assistant horticulturist, to fill the vacancy caused by the death of J. F. C. Du Pre. During the past summer the board has erected a veterinary hospital at a cost of $750. It is a two-story structure, 30 by 48 ft., with a basement 18 by 30 ft. The latter is divided into dissecting and post-mortem room, 18 by 18 ft., and fireproof room for alcoholic specimens, combustibles, etc., 12 by 18 ft. On the first floor are rooms for office, pharmacy, operating, and horseshoeing. On the second floor is a room for hospital attendant, space for feed bins, dog kennels, and poultry cages. The building is to be supplied with sewerage, water, and electric lights. It will be used in common for college and station purposes. In the agricultural division of the station interesting results are being obtained in cross breeding and hybridizing cotton, melons, etc., and special studies are being made of rice and its products by the chemical and botanical departments.

Tennessee University and Station.—Charles E. Chambliss, entomologist; J. B. McBryde, chemist, and R. L. Watts, secretary and horticulturist, have resigned from the staff. Mr. Watts is now engaged in commercial fruit culture in Pennsylvania. Charles A. Mooers, recently chemist at the North Louisiana Station, and former assistant chemist at the Tennessee Station, has been elected chemist. The agricultural department has been organized into three divisions, with an expert in charge of each, namely: Division of field plats, Phares O. Vanatter; division of feeding and dairy husbandry, George A. Flickinger, and division of practical agriculture, John R. Fain. Experiments are in progress in feeding dairy and beef cattle. Variety tests of wheat and forage crops, and experiments with green manure and artificial fertilizers are being carried on; also pot experiments to study the influence of lime on the Tennessee soils, and plat experiments to show the importance of seed selection. With the aid of the Office of Road Inquiry of this Department a half mile of macadam road is being constructed. A new course has been organized in agriculture, and a short course of twelve weeks will be introduced this winter for the first time. The agricultural department is compiling a handsome handbook for farmers. A new barn has just been completed at a cost of $5,000. This barn, which measures 56 by 88 ft., is provided with cement floors, triple silos, and complete arrangements of all kinds for experiments in feeding, etc. It consists of five distinct departments—the dairy stable, the horse stable, the silos, the storage barn, and the tool and implement sheds.

Texas College.—Charles H. Alvord, B. S., of the Michigan Agricultural College, has been elected to the position of assistant professor of agriculture in the college, vacated by A. M. Soule.

UTAH STATION.—U. P. Hedrick, horticulturist and botanist of the station, has become assistant horticulturist at the Michigan Agricultural College, and has been succeeded by C. P. Close, of the New York State Station.

VIRGINIA COLLEGE AND STATION.—The board of control has been reorganized and is now constituted as follows: C. E. Vawter, of Miller School; John Thompson Brown, of Brierfield; B. R. Selden, of Richmond; D. M. Cloyd, of Dublin, and J. M. McBryde (*ex officio*), of Blacksburg. A. T. Eskridge, assistant chemist, has been transferred to the college and made instructor in analytical chemistry, leaving W. B. Ellett the sole assistant chemist to the station.

WISCONSIN UNIVERSITY AND STATION.—J. A. Jeffery, assistant in agricultural physics in the university and station, has resigned to assume charge of the department in his line at the Michigan Agricultural College. At the September meeting of the board of regents Andrew Robinson Whitson, B. S., a graduate of the University of Chicago in 1894, was elected to succeed Professor Jeffery. He will begin active duties in the department of physics in the agricultural college in May, 1900, the intervening time being spent in special study in preparation for his work. J. W. Decker, instructor in cheese making, has resigned to assume charge of the dairy department of the Ohio State University.

AGRICULTURAL EXPERIMENT STATION AT CHOJNOWO, POLAND.—An association of thirty land holders has been formed to organize an experiment station in Chojnowo. The special objects of the station will be soil studies, including analyses and vegetation experiments, the examination of fertilizers, feeding stuffs, and seeds; field experiments, and seed production. The station will have a field of about 55 acres of land at its disposal, and a revenue of about 4,000 rubles (about $1,600) the first year. The management of the station will be in the hands of a board of five persons, with Dr. Casimir Rogóyski as director.

EXPERIMENT STATION FOR MILLING.—A new departure in the line of experiment stations is one for milling products, recently established at Berlin in connection with the Imperial Agricultural High School. Among the important objects of the station are the examination of flour, mill products, and bran for official purposes and for private parties, the analysis of oil cakes and other feeding stuffs for individuals, the furnishing of advice to millers and bakers, and the testing of implements. Investigations are to be made on such problems as the effect of storage of flour on its baking qualities, cause of differences in baking qualities of flours from different kinds of wheat, occurrence of diastases in flours, fixing of types of flours, etc. The director of the station is Prof. L. Wittmack, professor of agricultural botany in the agricultural high school. The management of the station is in charge of a board, of which Dr. Traugott Mueller, of Berlin, is chairman.

MISCELLANEOUS.—The Sixth International Congress of Agriculture will be held at Paris in connection with the Exposition of 1900 from the 1st to the 8th of July of next year. The congress will comprise the following sections: Rural economics, agricultural education, agronomy, breeding and care of live stock, agricultural engineering, special crops of southern France and the French colonies, and measures against parasites and for the protection of useful animals. Detailed information concerning the congress may be obtained from Henry Sagnier, general secretary of the commission of organization, Rue de Rennes 106, Paris.

An international congress for the rational feeding of animals will be held at Paris June 21-23, 1900, at which the following subjects are to be considered: Milk substitutes for feeding calves for breeding and for veal; influence of food on the fat content of milk; the rôle of saccharine materials in nutrition—use of molasses and sugar in the feeding of animals; importance of relative proportions of nitrogenous and nonnitrogenous materials in the rations of work animals; sale and purchase of feeding stuffs according to analysis—control of feeding stuffs, silage, and methods of desiccation for preserving feeding stuffs having a high water content (beets, potatoes, forage, etc.). Preliminary papers on the above subjects are requested and will be received by a committee, of which G. Gallo, Rue de la Victoire 69, Paris, is the secretary.

The annual meeting of the Association of Agricultural Experiment Stations in the German Empire was held at Munich September 16 and 17, 1899.

PERSONAL MENTION.—J. I. Schulte, editor of the department of field crops of this journal, has taken leave of absence for a year to continue his studies in France, especially with Prof. P. P. Dehérain, at Grignon.

Dr. W. Somerville, professor of agriculture and forestry at the College of Science, Newcastle-upon-Tyne, in connection with the University of Durham, has been elected to the new professorship of agriculture in Cambridge University.

G. Poirault has been appointed the successor of the late C. Naudin as director of the laboratory at Villa Thuret, at Antibes.

Prof. J. Kühn, of Halle, Germany, is making a study of some of the diseases of rye, and requests fresh material of *Tilletia secalis*.

A biographical sketch of the late Dr. E. Lewis Sturtevant, by C. S. Plumb, is given in the Tenth Annual Report of the Missouri Botanical Garden. A list of about 100 titles of articles is appended as a bibliography of his writings.

T. Francis Rivers died at his home in Sawbridgeworth, England, August 17 at the age of 68. He was widely known as the introducer of a large number of new varieties of peaches, nectarines, plums, pears, etc., many of which bear his name. At the time of his death he was chairman of the British Fruit Growers' Association.

Edward Frankland, the eminent English chemist, widely known for his work on water analysis, died recently while traveling in Norway, at the age of 75 years.

Prof. P. Freda, director of the agricultural chemical experiment station at Rome, died June 4, 1899, at the age of 43 years.

Henry Lévêque de Vilmorin, the eminent horticulturist, plant-breeder, and commercial seedsman, died August 23, 1899, at his home at Verrières le Buisson, Seine et Oise, France, at the age of 56. His death was sudden and was due to cerebral congestion.

Dr. G. de Chalmot, of Holcomb Rock, Va., died October 9, 1899. Although for a number of years past engaged in industrial chemistry, it will be remembered that during his connection with the Virginia State board of agriculture as chemist Dr. de Chalmot published a number of valuable papers on agricultural chemistry, notably on the pentoses and other carbohydrates.

EXPERIMENT STATION RECORD.

VOL. XI. No. 4.

An examination of the bulletins and reports of the experiment stations shows something of a dearth of veterinary literature, especially such as relates to investigations. Twenty-seven stations employ veterinarians or persons who are engaged in work on animal pathology related to veterinary science. In four cases the veterinarians are not carried on the rolls regularly but are consulting experts. Of the 4,000 reports and bulletins issued by the stations since their organization only about 325 are upon veterinary subjects, and a considerable proportion of these are largely popular bulletins representing little if any investigation. Nearly one half have been devoted to the subjects of dehorning, anthrax, glanders, hog cholera, swine plague, Texas fever, and tuberculosis. The last-mentioned disease has been discussed in about 60 bulletins. A large part of the work on tuberculosis has been confined to making tuberculin tests and reporting the results. From a practical sanitary standpoint this is very important, and taken as a whole it has taught many valuable facts regarding the proper use of the test and its practical application.

The stations have recently taken much interest in the prevention of such diseases as glanders, hog cholera, Texas fever, anthrax, and blackleg, in cooperation with the Bureau of Animal Industry of this Department, and have materially assisted in demonstrating the practicability of using new means for their prevention in general farm practice. In some cases valuable original work has been done by the station veterinarians along these lines. It is much to be desired that efforts to extend the use of serums, antitoxins, and other new methods for the treatment and prevention of animal diseases shall be accompanied by investigations to increase our knowledge regarding these diseases and their treatment.

With regard to the question as to how far the stations are warranted in undertaking to prepare the various antitoxins and serums for general distribution to stockmen, it would seem that the same rule should apply as in other departments of station work, e. g., that after the matter has passed the stage of experiment and demonstration it should be left to private enterprise, unless State funds are specially provided which can be used for the employment of assistants, so that the regular investigations may proceed without hindrance or interruption. As in other lines of station work, the idea that the veterinary department is for investigation rather than for inspection, general practice, preparation of remedies, etc., should be kept prominent.

There are several lines of work which especially seem to demand more attention than they are receiving at present. Some of these relate to the common contagious diseases of stock. It is perhaps desirable, for instance, to determine by actual experiments as nearly as possible the exact method of transmission of various contagious diseases. The causes of apparently isolated outbreaks of contagious diseases are not well enough understood. Incubation periods can often be determined more accurately. There are local conditions in each State which introduce new factors into the problem of every disease. These factors should be experimentally measured. In the case of milch cows especially there is needed a more definite experimental knowledge of the extent to which pathogenic organisms are transmitted.

The subject of disinfection, so intimately connected with the control and prevention of disease, presents a good field for some extremely useful work. The experimental knowledge bearing on this subject rests too largely on work performed under conditions quite different from those which ordinarily surround the stock farm or even the stables of an experiment station. Effective disinfection under these conditions is far more difficult and uncertain than in operations in human surgery or in the case of human habitations. In stables and barns rough surfaces are always to be found, usually very extensive in area, and various articles which are not easily disinfected. Disinfectants for this purpose should be of particularly high penetrating power and of active germicidal qualities. It is frequently necessary also to disinfect barnyards or paddocks which have become infected. The extent of surface and material to be disinfected requires large quantities of the disinfecting substances, and the expense of the ordinary disinfectant becomes an important practical consideration. It would seem that experiments undertaken with the object of determining the penetrating power and germicidal effectiveness of different disinfectants under different farm conditions might remove considerable of the uncertainty attending their use, and perhaps suggest more effective and practicable methods for the stockman in disinfecting his premises.

In connection with feeding experiments upon animals it is often observed that certain substances used as fodder have a beneficial or other effect upon the animal's health, but such observations are usually merely incidental and are not made in any systematic way. Especially in intensive feeding, the effect of the system of feeding on the general health of the animal may well be studied. In this way the work of the feeder and the veterinarian may often go hand in hand, and may bring forth results of much practical value.

In human medicine the study of the best sanitary methods is perhaps of fully as great importance to the welfare of human beings as the study of pathology and curative agents, and this is equally true when applied to domestic animals. The rules concerning animal hygiene and sanitation found in treatises on the subject of animal diseases are too often based upon conjectures or very insufficient data, and in many cases are drawn from the analogies of human sanitation. The great economical importance of animal industry warrants systematic investigation on this subject of hygiene and sanitation as applied to domestic animals, and the effects of the various factors of temperature, ventilation, food, water, exercise, etc., on the health of the animal and its ability to resist or withstand disease.

There is also a useful field for investigation on poisonous plants, especially in regions where range feeding is practiced and these plants are quite numerous. This is illustrated by the varied and contradictory opinions as to the nature and cause of so-called "loco" poisoning. Large losses of stock occur every year which are usually attributed to the poisonous effects of some plants, and which have not been definitely referred to known diseases. The effects upon stock of the smuts and ergot eaten with grasses and cereals are not clearly understood. Plants reputed to be poisonous are not always dangerous at all stages of their growth. Very few exact experiments have been made on this subject, and the general information is largely a matter of tradition or conjecture. There is good opportunity here for a useful line of experiments, and these experiments can best be made in the region where the trouble exists and where fresh material can be obtained.

Not every station can afford to take up veterinary work, as it involves an expensive equipment, and much of the investigation is in itself necessarily quite expensive. Where it is made a feature of the work, it seems the part of wisdom to devote sufficient funds to the department to make it a strong one and enable it to undertake investigations in a serious way. Some excellent pieces of work have been done by station veterinarians, and they should not be content to have their departments given over largely to the holding of clinics, giving of advice to stock owners, and police work, but should strive to raise the grade of their work. There are many large problems in every State for the solution of which the stockmen naturally look to the station, and in the end the most widespread benefit and the fullest recognition will come from larger devotion to these more fundamental problems.

RECENT WORK IN AGRICULTURAL SCIENCE.

CHEMISTRY.

A new method of ash determination, A. E. SHUTTLEWORTH (*Inaug. Diss., Göttingen, 1899, pp. 46, figs. 3*). Reported by B. Tollens (*Jour. Landw., 47 (1899), No. 2, pp. 173–200, pl. 1*).—An account of an investigation conducted in the laboratory of B. Tollens. The author found that the ash prepared by careful incineration in a muffle furnace at a low temperature was not completely extracted by hydrochloric acid, as shown by the high and varying percentage of silicic acid. Heated at a higher temperature the substance slagged or the ash smelted, thus preventing the complete action of the hydrochloric acid. A series of analyses of materials containing definite amounts of silicic acid and small portions of potassium and calcium carbonates showed that the residue insoluble in hydrochloric acid ("silicic acid") is frequently too high, the error increasing with the temperature at which the incineration was made.

Experiments were undertaken to prevent this formation of silicates undissolved by hydrochloric acid, which resulted in the adoption of acetate of lime for this purpose. This substance when mixed with the material to be incinerated was found to prevent slagging or smelting, even when the material was incinerated at a high temperature. The lime also hastens the incineration. The acetate of lime is used in the form of a solution containing about 0.2067 gm. of CaO in 20 cc. Usually about 20 cc. of the lime solution is used, although in some cases more is required. An excess does no harm. Data are given showing the advantage from the use of calcium acetate, and the method of preparing it is described.

The loss of chlorids in incinerating by the ordinary method was also studied, and it was found that this may be considerable, increasing with the heat used. For instance, the ash of a sample of oat straw when prepared with the greatest care contained 18 per cent of potash, while the ash of the same straw obtained by heating in a muffle at a high temperature contained less than 6 per cent of potash.

The author describes and illustrates an apparatus which he has devised to simplify the incineration and prevent losses. The apparatus, which is of platinum and weighs 70 gm., allows a current of air to be conducted through it and, in case it is desired, the determination of the carbonic acid directly in the apparatus without transferring the ash to a special carbonic-acid apparatus. In this apparatus, with the use of acetate of lime a substance can be completely incinerated without smelting or volatilization in less than 4 hours. The ash is weighed in the apparatus, so that the danger from absorption of moisture from the air is avoided.

The plan of the apparatus is shown in fig. 1, in which *f* is the deep platinum dish, the principal part of the apparatus; *e*, a tube with arms *e''* for stirring, and *e'* a small flat dish fastened to it. *d* is the cover, to which the cylinder *d'* bearing the outer cylinder *b* is soldered. *c* is a tube connecting at *x* with the tube *e* and carrying a shallow dish above the top of the cylinder *d'*. *a* is a cover fitting tightly over *b*, with a hole in the center for the tube *c*. The tube *c e* conducts air into the apparatus, and serves as a stirrer when rolled between the thumb and finger. The shallow dish at *c* is filled with distilled water to prevent the heating of the tube and to keep the outlet to the apparatus moist. Any portions of the ash which are carried along by too strong an air current are arrested in the cylinder *d'* or at the moist outlet.

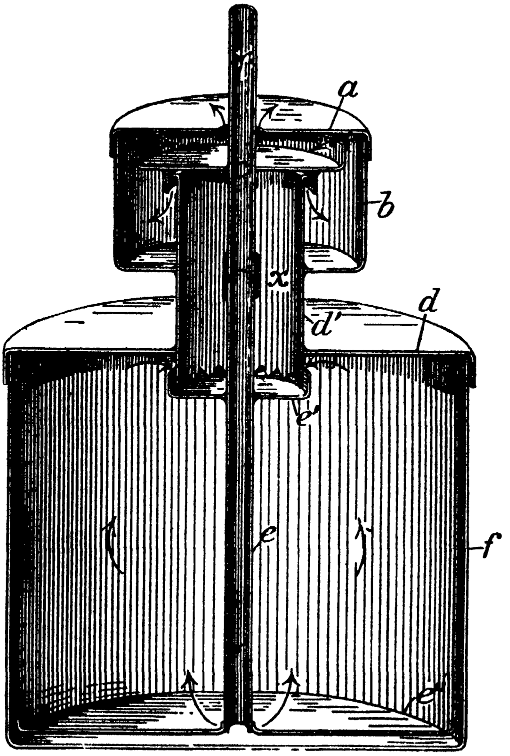

Fig. 1 —Apparatus for ash determination.

An especially constructed oven for the ash apparatus is described, together with the arrangement for carbonic acid determination.

Some notes on the estimation of carbohydrates, F. W. Traphagen and W. M. Cobleigh (*Jour. Amer. Chem. Soc., 21 (1899), No. 4, pp. 369–373*).—The authors present the following volumetric method for the determination of the reduced copper:

"One hundred cubic centimeters of Fehling's solution is diluted with 100 cc. of water and heated in a boiling-water bath. A known amount of sucrose or starch, contained in carefully analyzed samples which are as nearly as possible like the substance under analysis, is inverted. These solutions are used with similar solutions containing approximately known amounts of sucrose or starch. The amounts taken in each case are such that the precipitated cuprous oxid is nearly identical in weight. The precipitated cuprous oxid is collected on a Hirsch funnel covered with asbestus felt. After washing thoroughly with water the top layer of the asbestus carrying most of the cuprous oxid is transferred with a platinum spatula to the beaker in which the precipitation was made. The remaining asbestus is moistened and the cuprous oxid adhering to the side of the funnel is easily rubbed off. Water is added and the mass thoroughly stirred. Fifty cubic centimeters of a saturated solution of ferric sulphate in 20 per cent sulphuric acid is added. After the cuprous oxid is dissolved, filter on the same funnel, thus leaving it ready for another filtration. The solution is then ready for titration with potassium permanganate. The end reaction is clear and definite."

An electrical method for the determination of nitrogen, in organic substances, C. C. L. G. BUDDE and O. V. SCHOU (*Ztschr. Analyt. Chem., 38 (1899), No. 6, pp. 344–348, fig. 1*).—The authors give a preliminary description of an apparatus in which nitrogen is determined as in the Kjeldahl method, but with the aid of electrolysis. The digestion flask is made from a bulb tube (bulb of 50 to 100 cc. capacity) by closing one arm of the tube so as to form a depression of about 10 cc. capacity at the bottom of the bulb. The electrodes are placed in this depression with the substance, the anode being a piece of platinum foil bent into a cylinder, and the cathode a platinum wire hammered out flat. A pair of copper wires, each encased in glass tubing, extend through the neck of the flask nearly to the bottom, and the connections from the electrodes are fused into these tubes, the contact with the copper wires being made with mercury. The substance is mixed with 4 cc. of fuming and 8 cc. of concentrated sulphuric acid, and treated to an electric current for about three-quarters of an hour, when the liquid is usually colorless. At first a weak current is passed, but it is gradually increased to about 10 amperes and the liquid becomes strongly heated. After cooling, the acid is neutralized and the ammonia distilled off as usual in the Kjeldahl method.

The method is believed to possess marked advantages over the ordinary digestion, and does not require the addition of any foreign substance. A table shows that it usually gave results nearer the theoretical than the ordinary Kjeldahl method.

The Kjeldahl method of sugar determination, and the reducing power of cane sugar, G. BRUHNS (*Ztschr. Analyt. Chem., 38 (1899), No. 2, pp. 73–96*).—This is a critical investigation of Kjeldahl's method,[1] especially from the point of the sugar chemist. In this method the required quantity of Fehling's solution and the sugar solution are mixed in an Erlenmeyer flask, diluted to 100 cc., a current of hydrogen conducted through, and the solution heated for 20 minutes on a boiling water bath, after which the cuprous oxid is filtered off and weighed. The method is the same for all kinds of sugar, and does not necessitate the preparation of different Fehling solutions and the observance of special directions for each kind of sugar.

---

[1] Ztschr. Analyt. Chem., 35 (1896), p. 344.

The author found, however, that the method is not suitable when a large amount of cane sugar is present. Whether cane sugar in small quantity was a disturbing factor was not determined, but as it is a very common constituent of foods it will often prevent the use of the Kjeldahl method.

A method of analysis for canned condensed milk, F. S. HYDE (*Jour. Amer. Chem. Soc., 21 (1899), No. 5, pp. 439–444*).—A stock solution is prepared by diluting 25 gm. of the condensed milk with 75 cc. of water, which gives approximately 100 gm. of solution of very nearly the consistency of cow's milk. The determinations of solids, fat, and sugar are made in this stock solution by usual methods, weighing out the sample in each case instead of measuring. Citric acid is used for inverting the cane sugar, the author finding that this acid "usually does not produce coagulation in condensed milk solutions even on boiling." The degree of condensation is determined "by dividing the percentage of milk solids in the condensed milk by 12.5 per cent, the average of ordinary cow's milk."

The author gives analyses of a number of samples of condensed milk. "The amount of cane sugar averages between 30 and 40 per cent, and the fat below 12 per cent, which is not surprising in a manufactured article. In the so-called evaporated milks or creams, the cane sugar is usually absent."

On the experimental error involved in sampling crops, J. L. HILLS, B. O. WHITE, and C. H. JONES (*Vermont Sta. Rpt. 1898, pp. 155–159*).—In connection with an investigation of the influence of fertilizers on the composition of corn and potatoes (see p. 336), a study was made of the experimental error involved in sampling the crops. In 1896, each of the $\frac{3}{7}$-acre plats of corn was divided into two parts, each part being weighed separately, and samples averaging 325 lbs., or over 6 per cent of the crop, taken from each part. These samples were husked separately and the stalks and ears weighed. The sample from one part of each plat was subsampled by taking the ears and stalks separately, and that from the other part by cutting stalks and ears up together and then sampling the mixed mass. Four subsamples of 6 lbs. each were taken from each part, and these were rapidly dried in a fodder drier at 60 to 90° C. Dry matter determinations were made in 4 samples each of the whole plant, stover, and ears from each plat, and analyses were made of the combined samples in each case.

In 1897 the same general plan was followed, except that the entire crop on each part was used as a sample, and a larger number of subsamples was taken.

Each of the 114 rows of potatoes was weighed and sampled separately, great care being taken to make the samples representative. The samples averaged about 12 lbs. each, representing over 10 per cent of the entire crop.

Data of analyses of 184 samples are reported and discussed.

"While on the whole variations between the composition of crops differently fertilized are somewhat more marked than those between different samples from the same plat, yet they are not so pronounced as to admit of safe conclusions being drawn as to the effect of fertilization, unless results are quite positive and several samples are taken from each plat.

"No definite statement of the extent of the experimental error involved in single samples can be made. A careful comparison of the figures [reported] indicates, however, that the mean maximum variation of single samples from truth (average of several samples) lay (with the exception of ether extract) between 10 and 15 per cent. When several samples represent each plat the extent of the experimental error is proportionately minimized."

A contribution to the chemistry of butter fat: I, The physical and chemical constants of butter fat, C. A. Browne, Jr. (*Jour. Amer. Chem. Soc., 21 (1899), No. 7, pp. 612–633*).—The results of the examination of a considerable number of samples of butter fat, together with the methods employed, are given. "Nearly all of the analyses were of samples of butter made at the [Pennsylvania] Station creamery, and representing for the most part the product of a herd of high-grade Guernseys. The figures given in the tables accompanying this article need not be taken, therefore, as typical of butter fats in general, though we believe them to be, on the whole, fairly representative."

The range and means for some of the constants are given in the following table:

Physical and chemical constants of butter fat.

Constant.	Range.	Mean.	Number of samples represented.
Specific gravity, $\frac{40^\circ}{15.5^\circ}$	0.9050–0.9102	0.9073	35
Melting point	31.6°–34.6°	33.2°	35
Acid number	0.20–0.66	0.50	5
Saponification number	224.0–234.9	228.5	40
Ether number [a]	223.5–234.4	228	40
Iodin number	29.36–37.80	33.35	40
Reichert number (2.5 gm.)	15.10–17.50	16.2	40
Reichert-Meissl number (5 gm.)	22.80–32.10	28.3	10
Insoluble fatty acids, per cent	86.03–88.84	87.65	10
Soluble fatty acids, calculated	6.52–8.96	7.20	10
Total fatty acids, calculated	94.72–94.94	94.85	40
Acetyl number	3.5–4.8	4.1	5
Glycerol, calculated [b]	12.24–12.79	12.46	40
Glycerol, by analysis	12.30–12.70	12.45	10

[a] Saponification number less 0.5, the mean acid number.
[b] Calculated from figures given for ether number.

The methods employed in these investigations are described in detail, together with some modifications of the usual method of procedure.

"The determinations of the acid number were made upon samples of fat taken immediately after the butter was churned, so it will be observed that even when fresh, butter fat contains an appreciable amount of free acid. . . .

"The results show that the Reichert process gives a mean constant 10 per cent higher than the Reichert-Meissl method, after calculating the figures both to the same weight of fat. . . .

"The experience in this laboratory has been that only from 75 to 80 per cent of all the volatile acids pass over in one distillation. As a test, 10 distillations were made on 2.5 gm. of fat, the contents of the flask being replaced with 110 cc. of water after each distillation. The first fraction took 15.5 cc. of tenth-normal alkali, the succeeding nine fractions requiring each in their order 2.00, 0.95, 0.60, 0.55, 0.40, 0.35, 0.30, 0.30, 0.25, or together 5.7 cc., giving a total of 21.2 cc., thus making the original Reichert number of 15.5 over 25 per cent too small. . . .

"It is evident that while one treatment is amply sufficient to distinguish a butter from a substitute, the method is of little value quantitatively unless the treatment of washing be repeated until the washings become neutral—a tedious operation at the best. . . .

"Instead of distilling the lower fatty acids, it is possible to remove them from the higher insoluble acids by washing. The process can be carried out in connection with the determination of the saponification number, or with the determination of the insoluble acids."

In drying the fatty acids to a constant weight at 100° C. the use of a flask is preferred to an open dish on account of the continued loss of weight in the latter due to partial volatilization of the insoluble acids.

An apparent relation between certain of the constants is illustrated by tables.

"We notice that with an increase of the saponification number a quite uniform increase of the Reichert number takes place, while the iodin absorption decreases; these are such variations as one would expect. . . .

"It would seem as if the percentages of oleic and of the soluble acids in different butter fats bore a ratio somewhat complementary to one another. It must be remembered that the relations are only general and by no means fixed; there are butter fats which show constants bearing relations different from those expressed above, and from isolated cases a table might be constructed showing exactly opposite tendencies. As regards specific gravity and melting point, no definite relation could be discovered, though the latter showed a tendency to diminish as the saponification and Reichert numbers increased."

In conclusion the author mentions briefly some work by others on abnormal butter fats and on the influence of the ration upon the chemical composition of butter fat.

Egg albumin, T. B. OSBORNE (*Jour. Amer. Chem. Soc., 21 (1899), No. 6, pp. 477–485*).—The author prepared a quantity of crystallized egg albumin by the use of acetic acid and of a molecularly equivalent quantity of hydrochloric acid, obtaining from 1,500 cc. of egg white 80 gm. of wholly crystallized albumin with the use of acetic acid and 73.2 gm. with hydrochloric acid. The latter acid is preferred. The crystallized albumin was found to be a compound of a protein substance with an acid, and the indications were "that the acid is mostly, if not wholly, organic."

The composition and properties of a number of fractionally crystallized preparations are given.

"The composition, rotation, heat-coagulation points and reactions of the crystallized egg albumin obtained by aid of hydrochloric or acetic acids show this to be the same substance as that which has in the past been regarded as egg albumin.

"My results, those of Bondzynski and Zoja, and of Panormoff, make it plain that there are two protein substances in the egg white, which are commonly obtained admixed when preparing egg albumin by the usual processes. Whether the extremes of my fractional precipitations of these two albumins consist wholly or even largely of each one of these bodies requires further investigation of large quantities of egg white. This work we now have well under way."

On some definite compounds of protein bodies, T. B. OSBORNE (*Jour. Amer. Chem. Soc., 21* (*1899*), *No. 6, pp. 486–493*).—"The object of this notice is to state briefly some results of an investigation which leads to the conclusion that protein bodies, as hitherto prepared, are, in fact, definite chemical compounds of protein substance with common mineral acids, or contain such compounds in admixture.

"A large number of the purest protein preparations that it has hitherto been possible to make in this laboratory, including egg albumin several times recrystallized, edestin, legumin, excelsin, amandin, corylin, phaseolin, gliadin, hordein, and zein, are, without exception, acid to phenolphthalein, slightly acid or neutral to litmus, and decidedly alkaline to lacmoid."

Investigations with edestin compounds and derivatives are reported.

Xanthin bases in sugar cane, E. C. SHOREY (*Jour. Amer. Chem. Soc., 21* (*1899*), *No. 7, pp. 609–612*).—The author reports finding guanin in cane juice, the average of 6 samples of juice of approximately the same purity and composition showing 0.0012 per cent of guanin nitrogen. equivalent to 0.0025 per cent of guanin. The average of 4 samples of refuse molasses showed 0.0308 per cent of guanin nitrogen, equivalent to 0.066 per cent of guanin.

"The small amount of guanin present in cane juice is of little technical importance. The amount present in refuse molasses may, however, be worthy of note in considering the fertilizing or feeding value of the same.

"In the analysis of sugar cane and its products the presence of guanin may introduce an error in some cases unless its presence be recognized."

Proceedings of the fifteenth annual convention of the Association of Official Agricultural Chemists (*U. S. Dept. Agr., Division of Chemistry Bul. 56, pp. 140*).—This is a brief account, edited by H. W. Wiley, of the convention held at Washington, D. C., November 11, 12, and 14, 1898, which has already been briefly reported (E. S. R., 10, p. 504).

Methods agreed upon by the Belgian and Holland experiment stations, A. F. HOLLEMAN (*Landw. Vers. Stat., 51* (*1899*), *No. 4–5, pp. 357–365*).—This is very similar to an account of these methods already noted (E. S. R., 10, p. 304).

A step toward international cooperation in the methods used by the agricultural experiment stations, A. MAYER (*Landw. Vers. Stat., 52* (*1899*), *No. 1–2, pp. 165, 166*).—The author urges the importance of uniform methods, and mentions the recent union of the Holland, Belgian, and Luxemburg stations in this respect.

A common error in recorded results of proximate plant analysis, L. F. KEBLER (*Amer. Jour. Pharm., 71* (*1899*), *No. 1, pp. 25, 26*).—This relates to pharmaceutical analysis, and not to methods of fodder analysis.

The preparation of standard solutions of sulphuric acid, A. MARSHALL (*Jour. Soc. Chem. Ind., 18* (*1899*), *No. 1, pp. 4–6*).

Indicators for use in alkalimetry, F. GLASER (*Ztschr. Analyt. Chem., 38* (*1899*), *No. 5, pp. 273–278*).

A study of the relative value of lacmoid, phenacetolin, and erythrosin as indicators in the determination of the alkalinity of water by Hehner's method, J. W. Ellms (*Jour. Amer. Chem. Soc., 21 (1899), No. 4, pp. 359-369*).—From the data presented "it is quite apparent that any one of the indicators offers but little superiority over either of the other two. Erythrosin gives more uniform results and a larger percentage of the carbonates actually present with low amounts than with high amounts, while the reverse seems to be true of lacmoid and phenacetolin."

Determination of small quantities of sulphur in volatile organic materials, R. Lucion (*Bul. Assoc. Belge Chim., 13 (1899), No. 6, pp. 290-293*).—The use of potassium chlorate and other oxidizing reagents is discussed. The use of the bomb calorimeter, in order to obtain complete oxidation of the sulphur, is reported. The bomb used was not platinum lined, but enameled. No results are given. It is stated that the method of V. Tieftrunck is probably the best to follow, but it can not be used in many laboratories because of the want of a long heavy platinum tube.—H. SNYDER.

On a possible error in the determination of nitrogen in nitrates due to impurities in reduced iron, B. L. Hartwell and H. J. Wheeler (*Jour. Amer. Chem. Soc., 21 (1899), No. 5, pp. 468, 469*).—"Recently in making blank determinations with a new lot of so-called chemically pure reduced iron it was found that, by the modified Ulsch method, much less ammonia was required for neutralizing the acid than in the case of blank tests formerly made. The error from this cause in determinations involving half a gram of commercial sodium nitrate would amount to from 0.30 to 0.35 of a per cent. By direct distillation, without first allowing the iron to dissolve in the acid, no difficulty was experienced."

The authors refer to a similar observation by L. Brandt (E. S. R., 10, p. 819).

The determination of carbon and hydrogen in organic substances containing nitrogen, O. F. Tower (*Jour. Amer. Chem. Soc., 21 (1899), No. 7, pp. 596-605*).—The work reported shows that in burning amido compounds, the use of the copper spiral at the exit end of the combustion tube may be safely omitted —L. H. MERRILL.

The general usefulness of the Kjeldahl method for the destruction of organic substances previous to the determination of mineral matter, O. Gras and W. Gintl, Jr. (*Centbl. Physiol., 12 (1899), No. 11, pp. 308, 309*).

On the determination of albumoses and peptones, J. Effront (*Bul. Soc. Chim. Paris, 3. ser., 22 (1899), No. 14, pp. 680-683*).

The influence of temperature on the specific rotation of sucrose and method of correcting readings of compensating polariscopes therefor, H. W. Wiley (*Jour. Amer. Chem. Soc., 21 (1899), No. 7, pp. 568, 569*).—The results of readings at wide range of temperature are given, together with tables and formulas for corrections.

Rotatory power of sugar, E. Mascart and H. Bénard (*Ann. Chim. et Phys., 17 (1899), pp. 125-144; abs. in Sci. Abs., 2 (1899), No. 21, p. 627*).

Detection and determination of sucrose in the presence of lactose, E. Dowzard (*Jour. Chem. Soc. [London], 75 (1899), Apr., pp. 371, 372*).

Determination of sugar in molasses feed, O. Foerster (*Chem. Ztg., 23 (1899), No. 19, p. 196*).

Determination of the molasses content of molasses feeds, H. Neubauer (*Landw. Vers. Stat., 51 (1899), No. 6, pp. 421-439*).—A method is described.

Detection of corn starch in wheat flour, K. Bauman (*Ztschr. Untersuch. Nahr. u. Genussmtl., 2 (1899), No. 1, pp. 27-29*).

Determination of the quality of sugar beets, L. Sempolowski (*Landw. Vers. Stat., 51 (1899), No. 4-5, pp. 341-349*).—This article treats of the sampling in the field and the laboratory and the determination of sugar. Usual methods are employed.

Investigations on the aerometric method for determining fat in milk, H. Timpe (*Chem. Ztg., 23 (1899), Nos. 41, pp. 436, 437; 43, pp. 455-457*).—Investigation of Soxhlet's method and its application to milk unusually rich in fat.

Note on butter analysis, W. L. Gadd (*Chem. News, 80 (1899), No. 2076, p. 113*).—The author finds that "the change undergone by alcoholic potash on keeping has a serious effect upon the accuracy of Reichert's test, and in extreme cases probably renders the estimation valueless. On the other hand, by using fresh alcohol and solid potash concordant results are obtained, even with fat several weeks old."

Contribution to the study of the fatty acids of butter, VAN ENGELEN and WAUTERS (*Bul. Assoc. Belge Chim., 16 (1899), No. 6, pp. 282-290*).—A short study of the influence of different foods upon the composition of butter. The density, melting point, index of refraction (Abbé), fixed and volatile acids of butter are given when cows were fed 40 kg. of second-growth rape and straw and allowed to graze for an hour, and also when 2 kg. each of cotton-seed meal and wheat bran formed a part of the ration.—H. SNYDER.

On the detection of butter adulteration, A. J. SWAVING (*Ztschr. Untersuch. Nahr. u. Genussmtl., 2 (1899), No. 3, p. 274*).—Remarks on the limit for the Reichert-Meissl number.

An acoustical method for the determination of the melting point of fats and waxes, E. DOWZARD (*Chem. News, 79 (1899), No. 2053, pp. 150, 151, figs. 3*).

A new test for formaldehyde, N. LEONARD and H. M. SMITH (*Analyst, 24 (1899), Apr., p. 86*).—Milk containing formaldehyde is said to give a violet color when heated with 3 to 5 times its volume of concentrated hydrochloric acid, even when as little as 0.0001 per cent of formaldehyde is present; with over 0.1 per cent a yellow color is produced.

Tests for boric acid, V. LENHER and J. S. C. WELLS (*Jour. Amer. Chem. Soc., 21 (1899), No. 5, pp. 417-420, fig. 1*).

The detection of saccharin in foods, A. HASTERLIK (*Chem. Ztg., 23 (1899), No. 25, pp. 267, 268*).

Detection of sesame oil, A. BÖMER (*Ztschr. Untersuch. Nahr. u. Genussmtl., 2 (1899), No. 9, pp. 705-709*).

On some points in the analysis of water, G. H. BAILEY and J. H. JOHNSTON (*Jour. Soc. Chem. Ind., 18 (1899), No. 5, pp. 455-457*).

Determination of ammonia, nitric and nitrous acids in water, L. W. WINKLER (*Chem. Ztg. 23 (1899), Nos. 43, pp. 454, 455; 51, p. 541*).

On the use of hyposulphite for titration, especially for the estimation of oxygen in water and sewage effluents, B. W. GERLAND (*Jour. Soc. Chem. Ind., 18 (1899), No. 4, pp. 340, 341*).

Determination of oxygen in water, L. MUTSCHLER (*Ztschr. Untersuch. Nahr. u. Genussmtl., 2 (1899), No. 6, pp. 481-484, fig. 1*).

Determination of oxygen in water, F. ZETSCHE (*Ztschr. Untersuch. Nahr. u. Genussmtl., 2 (1899), No. 9, pp. 696, 697*).

Researches on moorland waters: I, Acidity, W. ACKROYD (*Jour. Chem. Soc. [London], 75 (1899), Mar., pp. 196-200*).—The article includes a description of the method of estimating acidity.

Measurements of turbidity in water, W. P. MASON (*Jour. Amer. Chem. Soc., 21 (1899), No. 6, pp. 516, 517, fig. 1*).—Describes the use of a brass tube 2½ in. in diameter and 2 ft. long, closed at the ends by disks of glass. The turbidity is determined by comparison with standards made with distilled water and exceedingly fine kaolin.

On rapid methods for the estimation of the weight of the suspended matters in turbid waters, C. L. PARMELEE and J. W. ELLMS (*Tech. Quart., 12 (1899), No. 2, pp. 145-164*).—Results are reported of comparisons of the following: Gravimetric method, standard clay solutions, photo-comparator, wire method, and diaphanometer. Any of the four last-named methods "gave fairly reliable results" when carefully standardized against the gravimetric method.

Analysis of commercial vinegar, F. G. RYAN (*Amer. Jour. Pharm., 71 (1899), No. 2, pp. 71-73*).—Analyses of 3 samples by the usual methods, "with a view of illustrating a class of analytical work that may be undertaken by graduates in pharmacy."

Detection of caramel in spirits and vinegar, C. A. CRAMPTON and F. D. SIMONS (*Jour. Amer. Chem. Soc., 21 (1899), No. 4, pp. 355-358*).—The authors suggest the use of fuller's earth, which extracts the caramel used in coloring but has very little effect upon natural coloring matter. "By means of Lovibond's tintometer the difference in color before and after treatment may be determined with a considerable degree of accuracy, and in this way more than twice as much color was found to have been absorbed from artificially colored spirits as from the natural."

Determination of fusel oil in alcoholic liquids, E. BECKMANN (*Ztschr. Untersuch. Nahr. u. Genussmtl., 2 (1899), No. 9, pp. 709-714, figs. 2*).

The analysis of human urine, W. CAMERER and SÖLDNER (*Ztschr. Biol., 38 (1899), No. 2, pp. 277-290*).—A large number of experiments on the analysis of urine are reported.

The estimation of arsenic in Paris green, T. SMITH (*Jour. Amer. Chem. Soc., 21 (1899), No. 9, pp. 769-772*).

A method for carrying out chemical reactions under high pressures, B. H. HITE (*Amer. Chem. Jour., 22 (1899), No. 1, pp. 80-86, pl. 1, figs. 5*).—A description of an apparatus in which substances can be subjected to intense pressure. As high as 400,000 lbs. to the square inch has been obtained; and other forms of cylinders are described in which pressures of from 50,000 to 200,000 lbs. to the square inch can readily be exerted.

New form of condenser, F. W. ASTON (*Chem. News, 79 (1899), No. 2059, p. 217, fig. 1*).

An electric drying oven, T. W. RICHARDS (*Amer. Chem. Jour., 22 (1899), No. 1, pp. 45-49, figs. 3*).

A simplification of Beckmann's boiling-point apparatus, S. L. BIGELOW (*Amer. Chem. Jour., 22 (1899), No. 4, pp. 280-287, fig. 1*).

A new form of potash bulb, W. C. ANDERSON (*Jour. Soc. Chem. Ind., 18 (1899), No. 2, p. 119, fig. 1*).

An improved apparatus for the estimation of carbonic acid in minerals, etc., A. MARSHALL (*Jour. Soc. Chem. Ind., 17 (1898), No. 12, pp. 1106, 1107, fig. 1*).

New laboratory apparatus, A. GAWALOWSKY (*Ztschr. Analyt. Chem., 38 (1899), No. 4, pp. 237-242, figs. 7*).—Descriptions of a burette tip, float, holder, and pinch cock, and apparatus for making distilled water on a large and on a small scale.

Apparatus for rapid analysis of milk, G. D. MACDOUGALD (*Jour. Soc. Chem. Ind., 18 (1899), No. 3, pp. 237-238, figs. 13*).—"The process is virtually the Leffmann-Beam, but the method of manipulation and apparatus are more or less novel." Special tubes, delivery apparatus for adding the acid, mixing apparatus, and a reading lantern are described. The apparatus is arranged for rapid work on a commercial scale, and the author explains that one of his assistants, with the aid of a boy, can easily make 120 to 140 determinations in 6 hours.

A new apparatus for determining solids and fat in milk, S. SONN (*Ztschr. Untersuch. Nahr. u. Genussmtl., 2 (1899), No. 8, pp. 655, 656, fig. 1; Ztschr. Analyt. Chem., 38 (1899), No. 6, p. 353, fig. 1*).—An aluminum boat with cover is used, in which about 20 cc. of milk is evaporated with about 2 gm. of fat-free cotton, and the solids weighed. The fat is determined in the residue by placing the open boat on end in a wide Soxhlet extraction apparatus, or in a nickel capsule with inside siphon tube, and this in turn in a glass jacket similar to that of an extractor. The fat is then extracted as usual.

A new filtering medium, G. W. SARGENT and J. K. FAUST (*Amer. Chem. Jour., 21 (1899), No. 3, pp. 287, 288*).

A new slide for the microscopical examination of water, foods, and feeding stuffs, A. HEBEBRAND (*Ztschr. Untersuch. Nahr. u. Genussmtl., 2 (1899), No. 9, pp. 694-696*).

Miscellaneous analyses, J. L. HILLS, B. O. WHITE, and C. H. JONES (*Vermont Sta. Rpt. 1898, pp. 176-181*).—These include analyses of 56 samples of water with reference to sanitary condition (see p. 328), 31 samples of sugar beets, 3 samples of muck, 2 samples of vinegar, and 1 sample each of whey, casein, and condensed milk.

Miscellaneous analyses, C. W. MCCURDY and T. SMITH (*Idaho Sta. Bul. 19, pp. 55-76*).—Analyses are reported of 36 varieties of strawberries (sugar content), 65 varieties of peas (sugar content), 6 samples of wines, 2 of vinegar, 2 of black pepper, 1 each of English breakfast tea, cream of tartar, breakfast food, baking powder, washing fluid, "silver" ware, and sunflower seed, 2 of lye, 7 of Paris green, 2 of sulphur, 3 of coal, 2 of hops, the ash of Wyoming coal, sage brush, yellow pine, white pine, red fir, tamarack, and box elder, and 21 samples of water (see p. 327).

Report of the senior analyst, Cape of Good Hope, 1898, C. F. JURITZ (*Cape Town: W. A. Richards & Sons, 1899, pp. 77, pl. 1*).—Contains a report of the analyses of foods, water and beverages, soils, fertilizers, sheep dips and disinfectants, prickly pears (young leaf, older leaf, stalk, inner portion of stalk), minerals, sea water, etc.

Report of the division of chemistry, A. M. PETER (*Kentucky Sta. Rpt. 1897, pp. XIII-XXX*).—This includes analyses of butter, cane juice, sugar beets, dried distillery feeds, tobacco sprayed with arsenic, Paris green and "laurel green," niter earth, hog manure, marls, wood ashes, phosphatic rock, kainit, potassium sulphate, by-product of manufacture of tobacco extract, dissolved bone, Damaraland guano, mineral waters, wine, coal, and coke.

BOTANY.

Report of the botanist, C. S. CRANDALL (*Colorado Sta. Rpt. 1898, pp. 138-141*).—A brief statement is made relative to the cooperative experiments conducted with the Division of Forestry of this Department in testing the relative hardiness of forest-tree seedlings grown from seeds produced in different sections of the country. Experiments were begun in 1897 and continued in 1898, and although the records thus far made are not considered conclusive, they show that in the matter of hardiness seedlings from northern seed have a decided advantage over those from southern seed.

Notes are given on the work of collecting the flora of the State, and numerous additions to the herbarium, made by exchanges, are reported.

The Colorado orchards have in the past been considered remarkably free from fungus diseases, but some of the more troublesome ones are beginning to be observed. In addition to the blight of apple and pear, already reported (E. S. R., 10, p. 266), the leaf spot of raspberries and blackberries has been observed in three counties and is doing considerable damage. The orange rust of blackberries and the leaf blight of strawberries are reported from several localities, and the powdery mildew of the cherry as well as a blight of cantaloupes is reported from the Arkansas Valley.

Report of the botanist, C. E. BESSEY (*Nebraska Sta. Rpt. 1898, pp. XXV-XXXIII*).—Some of the problems which presented themselves during the year are reviewed, and the opinion is expressed that it would be well for the station soon to take up the study of the physiology of plants with especial reference to the practice of irrigation.

Attention is called to the asparagus rust, which so far has not been reported from Nebraska, but should be watched for. The carnation rust has made its appearance in the greenhouse at the station. The stinking smut of wheat and the loose smut of wheat, oats, and barley are said to be quite common and require some attention.

A disease was found on potatoes which at first was thought to be downy mildew, but proved not to be. It appeared to be due to a fungus the exact nature of which was not determined on account of lack of material.

Specimens of wheat received from several localities were found affected with the wheat scab.

Notes are given on some poisonous plants and weeds which have attracted attention. Several cases of poisoning due to species of larkspur have been reported, and specimens of plants were obtained, but not sufficient to determine exactly the species of plant causing the trouble. "The Russian thistle has attracted but little attention the past season, and it is certainly not as threatening a weed as it was a few years ago." *Rumex acetosella* and the wild four o'clock (*Allionia nyctaginea*) are spreading throughout the State and in some localities becoming quite troublesome. A note of warning is also given concerning an annual mustard (*Erysimum repandum*) which has been reported from the northern part of the State and is likely to become troublesome if it secures a foothold.

Notes are given on various grasses and forage plants. A list of the titles of the principal papers which bear more or less directly upon agriculture published by the author during the year is reported.

A contribution to the knowledge of physiological constants, F. A. WAUGH (*Vermont Sta. Rpt. 1898, pp. 263-272*).—This report consists principally in a discussion of the theories of some of the earlier investigators upon this subject, the theories of DeCandolle, Linsser, and Hoffmann being discussed at considerable length. A number of American investigators are mentioned, among them Clarke, Waldo, Robertson, Bailey, and Irish, but no mention is made of the extensive investigations of C. H. Merriam in this line. After discussing the various theories, the author attempts to test some of them from data relative to the physiological constant of 6 varieties of plums at Geneva, N. Y. From the tabulation it appears that the sum temperatures at 32° are fairly constant for each variety, and the other constants are found to apply with a fair degree of accuracy.

The author concludes that the factors presented by various authors to explain modifications of physiological constants, although subject to exceptions, are applicable in certain circumstances, and that the determination of some physiological constants is possible. The various factors to be taken into consideration will be found useful, in proportion to their accuracy, in the scientific explanation of many puzzling variations in the periods of blooming, or maturing of fruits, flowers, and vegetables.

Concerning the temperature of plants, W. SOUTTER (*Rpt. Australasian Assoc. Adv. Sci., 7 (1898), pp. 572-575*).—The author briefly reports upon a number of experiments on the internal temperature of plants, the subjects of his experiments being young growing shoots of bamboo and banana, the fruit of a pumpkin, the flowers of *Cereus grandiflora*, and the fruits of cocoanut. Incidental to these investigations he reports notes made on the growth of bamboo. In 37 observations the total growth of the shoots in 24 hours was a little in excess of 19 in., in 69 cases it was 14 in., and in 111 others over 12 in. The maximum growth observed during 24 hours was 25 in.

In the temperature experiments, the maximum and minimum temperatures of the air with both wet and dry bulb thermometers are given, and the maximum and minimum temperatures within the growing tissues. Observations during 6 consecutive days are given of the internal temperature of bamboo shoots, on the last day the wet bulb thermometer showing a maximum of 76.5° F. in air, 89.3° in the bamboo shoots, with a minimum of 72.8° and 75.8°, respectively. In the banana stem the temperatures were as follows: Wet bulb in air—maximum, 86.6°; minimum, 63.8°; while in the banana stem the maximum registered was 90°, and the minimum 75.4°. In the experiments with the pumpkin the maximum air temperature was 78.4° and the minimum 64°; while in the fruit under investigation the temperatures were 81.2° and 66.6°, respectively. The experiments with the cactus flower gave readings from 10 to 15° higher than the air temperature.

In the experiments with cocoanuts 2 nuts were selected and placed in a box without soil and kept for 10 days in a room. A thermometer was inserted in one of them which registered 6.3° lower than the surrounding temperature. On the eleventh day the nuts were planted in the shade and germination begun. For 18 days there was no perceptible rise in temperature, after which time the temperature of the germinating nut began to rise rapidly. The experiment was terminated after 28 days, on which date the temperatures read as follows: Soil, 56.6°; atmosphere, 70.6°; interior of cocoanut, 83°.

Investigations on the nutrition of plants with organic nitrogenous compounds, L. LUTZ (*Ann. Sci. Nat. Bot., 8. ser., 7 (1899), Nos. 1, pp. 1–80; 2–6, pp. 81–103*).—The author reports a series of experiments in which about 20 different kinds of organic nitrogen were added to nutrient solutions in which a number of plants were grown. Most of the experiments with phanerogams were conducted with seedlings in sand cultures. The flowering plants experimented with were *Zea mays*, *Cucumis melo*, *C. prophetarum*, *Ipomœa purpurea*, *Cnicus benedictus*, and *Helianthus annuus*. Among the algæ were *Protococcus viridis*, *Mesocarpus pleurocarpus*, and *Oscillaria* sp., and among the fungi, *Penicillium glaucum* and *Aspergillus niger*. Especial precautions were taken to eliminate the action of bacteria, fixation of nitrogen by soil, and all forms of fermentation.

The results of the experiments showed that under as exact conditions as were possible to be obtained, the phanerogams were able to obtain their necessary nitrogen from organic nitrogenous compounds of the amin class, and this assimilation could take place without transformation into nitric or ammoniacal nitrogen.

The assimilation of organic nitrogenous compounds is confined to those of comparatively simple radicals. The methyl amins are readily assimilable, while benzyl amin and pyridin are not. The phenol amins act as strong poisons, and the compound ammonium salts and alkaloids are unable to supply the plants with the nitrogen, all samples after a while showing some loss in their initial nitrogen.

In the experiments with algæ and fungi similar results were obtained, the plants assimilating compounds of the simpler amin radicals with the same ease as nitric or ammoniacal nitrogen.

These results, the author claims, have a practical bearing in the practice of composting. In the case of beet or fruit refuse, shellfish and fish refuse, the organic nitrogen may be made available for plants without the transformation into ammonia or nitrates, the process of fermentation being checked when the lower amins are secured. In this way the frequently rapid action of manures may be explained.

The results obtained with alkaloids are thought to shed some light upon their rôle in plants. Alone they are entirely unassimilable, but when in conjunction with some assimilable form of nitrogen large quantities of them may be taken up, and it is thought possible in this way to explain the migration and disappearance of alkaloids in plants at certain times.

The assimilation of carbohydrates and elaboration of organic nitrogen in higher plants, Mazé (*Compt. Rend. Acad. Sci. Paris, 128 (1899), No. 3, pp. 185-187*).—The author quotes briefly the opinions of a number of investigators relative to the transformation of nitrates and the assimilation of carbohydrates by plants, and gives an account of experiments in which vetches, which had been sprouted in darkness and kept free from bacteria, were grown in sterilized nutritive solutions containing a variable quantity of glucose. The plants were placed in these sterilized solutions when they were from 8 to 10 cm. in length, and were grown in darkness for different periods of time. The following table will show the results obtained in one series of cultures:

Assimilation of carbohydrates by plants.

Lot.	Time of experiment.	Glucose.	Dry weight of seed.	Dry weight of plant.	Gain (+) or loss (—).
	Days.	*Per cent.*	*Mgs.*	*Mgs.*	*Mgs.*
No. 1	50	1	202. 8	269	+ 66. 2
No. 2	39	2	202. 8	276 7	+ 73. 9
No. 3	92	4	202. 8	838. 2	+635. 4
No. 4	92	6	202. 8	710	+507. 2
No. 5	53	0	202. 8	161. 6	— 41. 2
No. 6 [a]	53	0	202 8	133. 4	— 69. 4

[a] No nitrogen in culture solution.

The above table shows that these plants were able to transform the glucose into their necessary carbohydrates, and also to elaborate albuminoid material. The plants grown in the glucose solutions were much more vigorous than those in the check. Their taproots were strong and well branched. and the stems attained a much greater length.

amounting to as much as 1.3 meters, with branches extending 1.65 meters. The nitrates were found throughout the stems to the last internode, the meristomatic tissue being the center of the most active transformation of nitrates.

Sap pressure and flow in the sugar maple, L. R. JONES and W. A. ORTON (*Vermont Sta. Rpt. 1898, pp. 234–236*).—Preliminary investigations upon this subject were conducted by W. J. Morse during the season of 1897, which was a notably poor and quite short one for sap flow. The problems presented will require the observations of a series of years. After describing the methods, the authors state that a close relation exists between sudden rises of temperature and of sap pressure, and also that the line of pressure is somewhat more tardy in its general rise and fall than is that of temperature.

The direction of the sap flow during the sugar season is a matter of considerable difference of opinion, and, to test this, lithium chlorid was injected into the tree. The results obtained show conclusively that in ordinary conditions there is an almost equally rapid movement of the sap current both upward and downward in the vicinity of the spout. Similar methods were used to determine the existence or nonexistence of lateral flow, but the results were entirely negative. The conclusion seems clear that the sap moves freely in both directions with the grain of the wood, but very slowly across it. An unexpected result obtained was the rapid decrease in the amount of the lithium, ending in some cases in its total disappearance in the sap within 24 hours.

How can the efficiency of Nitragin be increased? F. NOBBE and L. HILTNER (*Landw. Vers. Stat., 51 (1899), No. 6, pp. 447–462*).—The authors reply to various criticisms on the efficiency of Nitragin, and suggest methods whereby its activity may be increased. The principal thing to be observed is to have the bacteria present at what is termed the critical period, between the time of inoculation and the time when the young roots are capable of being infested. It is considered of prime importance that this period should be as short as possible, and in seed inoculation the authors now recommend the addition of the cultures to the seed after they have been soaked from 12 to 24 hours, or, in the case of seed which are long in germinating, after 3 or more days.

Where soil inoculation is practiced, it is advised that the bacteria cultures be mixed with finely cut leguminous hay and sown over the field after the first plants begin to appear. The authors state that this method adopted some weeks after the seed were sown gave greatly increased results over their checks.

The evolution of plants, D. H. CAMPBELL (*New York: The Macmillan Co., 1899, pp. VI+319, figs. 60*).—In this book, which is expanded from a course of lectures in Leland Stanford Junior University, the author has sought to give an accurate though not strictly technical statement of the present state of our information regarding the genealogical history of the plant kingdom. While primarily designed for botanists, its untechnical character commends it to every student of evolution. All sources of information have been freely drawn upon, and the result is one of the most orderly arrangements of the plant kingdom of which we have any knowledge. Exceptions may be taken to the position of certain disputed groups, but until more is positively known concerning them their true position can only be doubtfully assigned. The chapters on geological and geographical distribution and the influence of environment are very suggestive of reasons for many apparent anomalies in nature.

Foreign seeds and plants imported by the Section of Seed and Plant Introduction, O. F. Cook (*U. S. Dept. Agr., Division of Botany Inventories 1, pp. 81; 2, pp. 94; 3, pp. 14; 4, pp. 9*).—These contain lists of the seeds, plants, cuttings, etc., secured by the special agents of the Section of Plant Introduction, through exchanges and by other means. The first consists principally of lists of seeds and plants which have been secured by N. E. Hansen during a trip to Russia, Central Asia, and Siberia. Inventory No. 2 continues the list secured by Mr. Hansen, and gives lists of materials collected by W. T. Swingle, and other miscellaneous collections. Inventory No. 3 gives a list of the improved varieties of sorghum which have been developed by the Division of Chemistry of this Department, and now made available to the experiment stations through this section. Inventory No. 4 enumerates and describes the cereals and forage plants secured by M. A. Carleton in Russia for distribution through this section.

Notes on grasses of Nebraska, South Dakota, and Wyoming, L. H. Pammel (*Proc. Davenport Acad. Sci., 7 (1899), pp. 229–245, pls. 7*).—Ecological and economic notes are given of the grasses of this region, and the following new species described: *Phleum alpinum scribnerianum*, *Melica pamelii* Scrib., *Poa wyomingensis* Scrib., and *Hordeum cæspitosum* Scrib.

Secale africanum, O. Stapf (*Hooker's Icon. Plant., 7 (1899), No. 1, Plate 2601*).—The author describes as new this species of rye, which is said to be so abundant as to lend its name to the region. It is considered a very distinct species and not a degenerate variety of *S. cereale*.

Observations on the denudation of vegetation, M. Manson (*Pacific Rural Press, 58 (1899), No. 8, p. 116*).—Suggests remedies for Californian conditions.

The opening lecture of the course of vegetable physiology applied to agriculture at the Museum of Natural History, P. P. Dehérain (*Ann. Agron., 25 (1899), No. 5, p. 212*).—An outline is given of the proposed work, which was to be principally concerned with studies of natural and artificial meadows.

On the occurrence of lignin in the vascular cryptogams, K. Linsbauer (*Oesterr. Bot. Ztschr., 49 (1899), No. 9, pp. 317–323*).

The relation between the color of daffodils and the composition of the soils in which they are grown, A. P. Aitken (*Trans. and Proc. Bot. Soc. Edinburgh, 21 (1898), pt. 2, pp. 113–116*).—Marked differences having been noted in daffodils grown in different places, analyses of the soils were made. It was found that the intensity of color increased with the percentage of organic matter, phosphoric acid, lime, and peroxid of iron. Whether all or some particular item is the cause of the increased intensity of color is to be investigated further.

The biology of pollen, B. Lidforss (*Jahrb. Wiss. Bot. [Pringsheim], 33 (1899), pp. 232–312; abs. in Jour. Roy. Micros. Soc. [London], 1899, No. 4, p. 411*).—The author claims that moisture is not generally destructive of the germinating power of pollen grains, and that the resistance of pollen to moisture is often greatly influenced by external conditions, it being greatly enhanced in moist air. As a rule, those pollen grains which are unable to resist moisture germinate very rapidly. The pollen grains of anemophilous plants are, as a rule, characterized by their comparatively small size. While containing a larger proportion of starch, they have less nitrogenous matter than those of entomophilous plants.

Causes of the direction of the lateral branches of trees, J. Baranetzky (*Sitzber. Bot. Sec. Naturf. Ver. Kiew, 1898, Aug. 28; abs. in Jour. Roy. Micros. Soc. [London], 1899, No. 4, p. 412*).—The development of the lateral branches of trees is said to present two different types. In one, represented by the maple, ash, chestnut, etc., the physiological properties of the lateral branches are the same as those of the erect main stem, their oblique direction being due to the angle at which they branch from the main stem. In others, as in the linden, elm, etc., the lateral branches are physiologically bilateral even in the bud. In pines, all the first year's shoots are erect, the subsequent bending down of the lateral branches being due to the unequal growths of the tracheids.

Downward growth of rhizomes, A. RIMBACH (*Beitr. Wiss. Bot., 1. Abt., 3 (1898), pp. 117-204; abs. in Jour. Roy. Micros. Soc. [London], 1899, No. 4, pp. 412, 413*).—The power of rhizomes or other underground organs to rise or sink deeper into the soil is attributed to changes in the direction of the growth in length due to the shortening or elongation of the internodes of the stem, rarely to the lateral extension of the underground organ itself. It is influenced by the depth of covering of the soil, a slight covering inducing descent, while a deep covering will cause an ascent of the rhizome, etc. The author claims that this phenomenon can not be explained by heliotropism or aerotropism.

Seedless grapes, MÜLLER-THURGAU (*Landw. Jahrb. Schweiz, 1898, p. 71, pls. 4; abs. in Jour. Roy. Micros. Soc. [London], 1899, No. 4, p. 407*).—The author attributes the absence of seeds in some grapes to two causes, namely, the pollen grains may be well developed, but the ovules incapable of impregnation; either the pollen tubes do not reach the ovules or the ovule itself is sterile. To this class belong the Sultanas and currants of commerce. In the second class the ovules are capable of impregnation, but the pollen grains are degenerated; either the pollen tubes do not germinate or are incapable of impregnating the ovule cell. Grapes which do not contain seeds are always smaller than those of the same variety containing them.

The effect of various substances upon the respiration and assimilation of submerged plants, B. JACOBI (*Flora, 86 (1899), No. 3, pp. 289-327*).—The effect of carbon dioxid, potassium nitrate, potassium chlorid, sodium chlorid, quinin, antipyrin, thyroidin, and iodin on *Elodea canadensis* and *Myriophyllum verticillatum*, as shown in their respiration and assimilation, was investigated and reported upon. Different effects were sometimes noted for equal strengths of solution on respiration and assimilation, the one being stimulated and the other retarded.

On the absorption of nutrient substances by roots, L. KNY (*Ber. Deut. Bot. Gesell., 16 (1898), pp. 216-236; abs. in Jour. Roy. Micros. Soc. [London], 1899, No. 3, p. 296*).—The author conducted experiments upon maize, peas, and *Hydrocharis morus-ranæ*, in which the absorption of methyl violet and of nitrates was demonstrated. The results were by no means uniform, individuals of the same species showing great variation. The absorption of nutrient substances by roots is said to take place not only through the root hairs but through the epiderm in a zone of varying length on the apical side of the root-hair region.

Hydrocyanic acid in plants, A. HÉBERT (*Bul. Soc. Chim. [Paris], 3. ser., 19 (1898), pp. 310-313; abs. in Jour. Roy. Micros. Soc. [London], 1899, No. 4, p. 405*).—The presence of traces of hydrocyanic acid is reported in red and black currants, young green shoots of *Ribes aureum*, the embryo of *Eriobotrya japonica*, and in the leaves, stalks, and buds of *Aquilegia vulgaris* at the commencement of the period of vegetation. The quantity present is not considered sufficient to act as a means of defense.

Hydrocyanic acid in the Amygdaleæ, A. J. VAN DE VEN (*Arch. Neerland Sci. Exact. et. Nat., 2 (1899), pp. 383-396; abs. in Jour. Roy. Micros. Soc. [London], 1899, No. 4, p. 405*).—The author states that the quantity of hydrocyanic acid in the branches of cherry-laurel decreases with increase of age. There is little evidence of the presence of this acid in the roots of this plant. In the youngest leaves the acid occurs only in isolated groups of cells along the principal veins, the proportion reaching in early summer as much as 2.4 per cent. The amount of the acid in the leaves may be decidedly increased by insolation. The author claims to have been unable to find any trace of hydrocyanic acid in *Vicia sativa* or in other species of the genus, or in *Aquilegia vulgaris*, where it has been stated to exist.

On the digestion of starch in plants, LECLERC DU SABLON (*Compt. Rend. Acad. Sci. Paris, 127 (1898), No. 23, pp. 968–970*).

The presence and function of silica in plants, B. VON SWIECICKI (*Halle, 1898, pp. 45; abs. in Jour. Roy. Micros. Soc.* [*London*], *1899, No. 3, p. 292*).—The author claims that in the case of cereal crops the upper portion of an internode is always stronger than the lower in consequence of its containing a larger amount of silica. The greatest strength was found in the first and fifth internodes, and the upper part of the fifth internode in particular contains much more than the average proportion of silica.

Formation of sugar in beets, M. GONNERMAN (*Ztschr. Ver. Deut. Zuckerind., 1898, pp. 667–689; abs. in Jour. Roy. Micros. Soc.* [*London*], *1899, No. 3, p. 301*).—It is stated that the formation of sugar in the leaves of the beet can take place only through the action of an enzym. There are present in beet leaves two enzyms, an invertase and a diastase, both of which are distinct from the corresponding enzyms of barley. By their action starch is transformed by hydrolysis into products which are then changed into saccharose partly in the leaves and more completely in the parenchyma of the root.

The physiological importance of the furfuroids in the organism of the sugar beet, J. STOKLASA (*Ztschr. Zuckerind. Bohmen, 23, p. 291; Neue Ztschr. Rübenz. Ind., 42 (1899), No. 19, pp. 204–207*).

Anatomy and physiology of sugar-beet seed, A. NESTLER and J. STOKLASA (*Bul. Assoc. Chim. Sucr. et Distill., 16 (1899), No. 10, pp. 972–980, figs. 2*).

Protein destruction and regeneration in plants, N. PRIANISCHNIKOW (*Ber. Deut. Bot. Gesell., 17 (1899). No. 4, pp. 151–155*).—A preliminary report of experiments with *Pisum sativum*, *Vicia faba*, and *Lupinus luteus* to determine the process of destruction and regeneration of protein. Investigations by various authors on *V. sativa*, *V. faba*, *Pisum sativum*, *Phaseolus multiflorus*, *L. luteus*, and *Cucurbita pepo* are quoted.

The ecological relations of the vegetation on the sand dunes of Lake Michigan, H. C. COWLES (*Bot. Gaz., 27 (1899), Nos. 4, pp. 281–308; 5, pp. 361–391, figs. 26*).

Influence of external agents on the anatomical structure of maritime plants, J. SCHMIDT (*Bot. Tidsskr., 22 (1899), No. 2, pp. 145–168, figs. 7*).—Experimental investigations upon *Lathyrus maritimus* as influenced by saline solutions and light.

Some observations on the effect of distilled water on the roots of plants, N. SCHOULTZ (*Compt. Rend. Soc. Imp. Nat., 28 (1897), pp. 217, 218*).

Effect of Roentgen rays on plants, G. TOLOMEI (*Rend. Accad. Lincei, Rome, 7. ser., 5 (1898), No. 1, pp. 31–39*).

Lichens on plum trees, F. A. WAUGH (*Vermont Sta. Rpt. 1898, pp. 289–290, pl. 1*).—While engaged upon pollination experiments with plums the author noted the occurrence of a number of species of lichens, especially on old trees. A quantity of material was collected and at least 12 species were determined. As has already been shown by Waite,[1] the application of Bordeaux mixture is a specific for the removal of these unsightly if not injurious plants.

Influence of light on the development of fungi, F. GRAEWITZ (*Ueber den Einfluss des Lichtes auf der Entwickelung einiger Pilze. Leipsic, 1898, pp. 74; abs. in Jour. Roy. Micros. Soc.* [*London*], *1899, No. 4, p. 420*).—From a series of experiments made chiefly on *Pilobolus microsporus* and *Coprinus stercorarius*, the author claims that the ripening of sporangia is not necessarily dependent on an entire absence of light although normally it takes place at night. On the other hand, the sporangia of Pilobolus and the pileus of Coprinus are not differentiated in perpetual darkness. The rapidity of the development of the receptacle increases with the intensity of the light.

A statistical enumeration of Australian fungi, D. MCALPINE (*Rpt. Australasian Assoc. Adv. Sci., 7 (1898), pp. 482–488*).—Notes are given on a number of species of fungi and their distribution in Australia, tables being given showing the proportion of species in the different colonies and comparisons made with the known species occurring in Great Britain. At the end of 1897 there were known to occur in Australia 12 groups of fungi containing 2,480 species. Of these about 31 per cent are common to Great Britain.

---

[1] Jour. Myc., 7 (1893), p. 265.

The biology of parasitic fungi, M. NORDHAUSEN (*Jahrb. Wiss. Bot. [Pringsheim], 23 (1898), pp. 1–46; abs. in Jour. Roy. Micros. Soc. [London], 1899, No. 3, pp. 310, 311*).—*Botrytis cinerea* ordinarily a saprophyte may become parasitic, forcing entrance into the tissues of the host plant. Culture experiments seem to indicate that the fungus secretes two substances, one of which is poisonous to protoplasm and the other destroys the cellulose of the cell wall. These substances are probably enzyms. By this means the fungus is able to attack almost any plant in nearly any part. Somewhat similar results were secured with *Mucor stolonifer* and *Penicillium glaucum*, although in general the last species does not appear to secrete a poisonous enzym.

On the biology of wood-frequenting fungi, F. CZAPEK (*Ber. Deut. Bot. Gesell., 17 (1899), No. 5, pp. 166–170*).

The modification of characters in the Uredineæ, P. MAGNUS (*Ber. Deut. Bot. Gesell., 17 (1899), No. 5, pp. 178–184, pl. 1*).

Spore formation in Dematium pullulans, F. WELEMINSKY (*Centbl. Bakt. u. Par., 2. Abt., 5 (1899), No. 9, pp. 297–303, figs. 9*).—The author figures and describes the method of spore formation in this fungus.

The decomposition of glucosids by fungi, K. PURIEWITSCH (*Ber. Deut. Bot. Gesell., 16 (1898), pp. 368–377; abs. in Jour. Roy. Micros. Soc. [London], 1899, No. 3, p. 301*).—The mycelium of *Aspergillus niger*, *A. glaucus*, and *Penicillium glaucum* is said to have the power of decomposing glucosids in the same way that emulsin acts upon them. The spores have the same power when germinating. The substances resulting from the decomposition are glucose and some benzol derivatives. The glucose is taken up by the mycelium, while the other may be absorbed or remain in solution.

A contribution to the knowledge of endotropic mycorrhiza, J. BERNATZKY (*Termesz. Füz. Budapest, 1899, pp. 23, pls. 2*).

Biological species and races, E. ROSTRUP (*Bot. Tidsskr., 20 (1898), pp. 116–125; abs. in Jour. Roy. Micros. Soc. [London], 1899, No. 3, p. 301*).—The author distinguishes between these two terms as applied to fungi. In the case of biological races the capacity for one form to pass over into another has been only partially lost, while in biological species it has entirely disappeared. Biological races are said to occur in *Lophodermium pinastri*, and biological species in the genera Coleosporium and Melampsora. In *Puccinia graminis* there are a number of biological races, each of which is limited to a definite host plant, while biological species also occur in the same genus.

Three edible species of Coprinus, G. F. ATKINSON (*New York Cornell Sta. Bul. 168, pp. 491–516, figs. 15*).—In continuation of his studies and illustrations of mushrooms, the author describes 3 edible species of Coprinus, namely, the shaggy mane (*Coprinus comatus*), ink cap (*C. atramentarius*), and the glistening Coprinus (*C. micaceus*).

METEOROLOGY.

Lightning and the electricity of the air, A. G. MCADIE and A. J. HENRY (*U. S. Dept. Agr., Weather Bureau Bul. 26, pp. 71, pls. 4, figs. 21*).—This bulletin contains two parts.

"Part I deals with the electrification of the atmosphere and the best method of protecting life and property from lightning stroke, being in large part a revision of Bulletin 15, Protection from Lightning [E. S. R., 8, p. 31]. Part II gives statistics of actual losses of life and property, including live stock in the fields, sustained in the United States during 1898.

"The aim of the paper is to furnish information of practical value to all persons, especially those who may have occasion to seek protection from lightning."

The statistics collected show that during the 9 years, 1890–1898, 2,496 deaths due to lightning occurred in the United States—or about 5 per million of the population. During 1898, 1,866 buildings were struck and damaged, the total estimated loss being $1,441,880. The number of fires due to lightning during 1890–1897 was 7,558, the estimated loss from this cause being $17,672,772. The recorded loss of live stock by lightning stroke in 1898 was, cattle 964, horses 306, mules 30, pigs 116, and sheep 436, valued at $48,257.

"The order of frequency of lightning stroke on the various soils in percentages, deduced from 380 reports, is as follows: Loam, 26 per cent; sand, 24 per cent; clay, 19 per cent; prairie, 19 per cent; scattering, 12 per cent."

Meteorology, L. G. CARPENTER (*Colorado Sta. Rpt. 1898, pp. 174–176*).—A brief account is given of the work of the station in this department, especially of observations on rainfall, sunshine, and soil moisture. "To determine our rainfall normal at this place, we now have 20 years' observations for most months. The normal thus obtained for the whole year is 13.26 in." Ten years' sunshine records have been secured but have not been measured and reduced.

Meteorological record (*Minnesota Sta. Rpt. 1898, pp. 561–566*).—Tables of normal monthly and annual temperatures and precipitation for some 35 stations in Minnesota having records for 5 or more years, with annual and monthly temperatures and precipitation at 69 stations during 1897.

Report of the division of meteorology, V. E. MUNCY (*Kentucky Sta. Rpt. 1897, pp. XXXVI–XL*).—A tabular summary of meteorological observations during 1897 on temperature, pressure, precipitation, sunshine and cloudiness, wind, thunderstorms, snow, hail, and fogs. The mean temperature for the year was 55.7 F, the highest 96°, September 14, and the lowest —6, January 25. The total rainfall was 49.19 in.

Explosions to prevent hailstorms, E. OTTAVI (*Chron. Agr. Canton Vaud, 12 (1899), No. 14, pp. 331–334*).—Refers to what purport to be successful experiments in Styria.

On the blue color of the sky, J. M. PERNTER (*Wiener Akad. Anz., 1899, p. 193; abs. in Naturw. Rundschau, 14 (1899), No. 30, pp. 383, 384*).

WATER—SOILS.

Study of evaporation, J. E. PAYNE (*Colorado Sta. Rpt. 1898, pp. 212–215*).—Observations on the rate of evaporation from water surfaces and from different types of soil are reported.

"[In the first case] two galvanized iron cans 18 in. in diameter and 52 in. deep were set close together in the ground so that the tops of the cans were on a level with the surface. These were filled with water. During July the evaporation was 11.38 in. Both were exposed equally to the action of the sun and wind during this time. August 1 one was screened from the direct rays of the sun and the other was left uncovered. From August 1 until September 24 the one in the shade lost 14.75 in., while the one in the uncovered can lost 18.43 in.

"The can which was uncovered was left until October 3, when it was found that it had lost 35 31 in. during the time from July 1 until October 3, or 95 days."

For the observations on evaporation from the soil 4 different kinds of soil were used: (1) an upland soil of a mulatto color, containing a small amount of clay, considerable sand, and enough lime to cement it, so that it is quite hard when in its natural condition; (2) a very fine black soil from a hilltop; (3) a rich clay soil of dark color, and (4) a fine light-colored soil, commonly called gopher clay. Cans 18 in. in diameter and 52 in. deep were filled with these soils, a layer of subsoil being placed at the bottom of each can. The cans were placed in a trench so that their tops were on a level with the surface of the ground. Water was added from time to time through a piece of gas pipe which extended 2½ ft. below the surface, the total amount added being equal to 3 in. of rainfall for each can. The soils were kept bare and uncultivated. At the end of 85 days the loss in weight was determined. This was found to be for soil No. 1, 1,038 tons per acre; for soil No. 2, 527 tons per acre; soil No. 3, 435 tons per acre, and soil No. 4, 600 tons per acre.

> "Four other cans just like the ones described were filled with subsoil and soil of type No. 1. In two of these millet was planted, while two of them were left bare. After 85 days it was found that the average loss from the bare soils was 905 tons per acre, while the average loss of the two upon which millet was growing was 1,056 tons per acre. The millet grew to be only 4 to 6 in. high before it formed heads. Three inches of water besides the rainfall was added to each of these cans also."

Other observations on evaporation from the soil were made in connection with a study of the influence of a wind-break. The wind-break was a sod wall and close board fence 4 ft. high, running east and west. Twenty galvanized-iron buckets, 11½ in. in diameter, were filled to the same level with soil No. 1 and sunk in the ground, at distances of from 1 to 10 ft. from the wind-break, so that their tops were on a level with the surface. Ten of the buckets were in buffalo grass sod and 10 in a millet field. Water was added to each bucket occasionally by means of glass tubes reaching nearly to the bottom. During 62 days, beginning July 13 and ending September 13, the average loss of water per acre from the soil in the buckets was 705 tons. As in the previous experiments the soil was uncultivated and bore no vegetation.

The influence of the wind-break is shown in the following table:

Evaporation during 62 days, July 14 to September 14, from buckets of soil at different distances from a wind-break.

	Water evaporated per acre during 62 days.	
	North of wall in sod.	South of wall in millet.
	Tons.	*Tons.*
Buckets 1 rod from wall	677	647
Buckets 3 rods from wall	633	686
Buckets 5 rods from wall	700	738
Buckets 7 rods from wall	703	704
Buckets 8 rods from wall	....	761
Buckets 10 rods from wall	712	....

Electrical instruments for determining the moisture, temperature, and soluble salt content of soils, L. J. BRIGGS (*U. S. Dept. Agr., Division of Soils Bul. 15, pp. 35, figs. 12*).—These methods have been described as they have been developed (E. S. R., 9, p. 535; 10, p. 30).

"It is the object of this bulletin to describe the instruments and methods at present employed by this Division in investigating the moisture and temperature of soils in the field, together with a convenient field apparatus for investigating the soluble salt content of soils. Several important modifications in the instruments and methods, as previously described in other bulletins of the Division, have been made. A special instrument is now used for each of the three classes of determinations, instead of a single instrument as heretofore. This change greatly simplifies the instruments, makes them easier to operate, materially lessens their cost, and in the case of the moisture and temperature instruments permits the use of direct reading scales, thus avoiding, except in cases where more than ordinary accuracy is desired, the necessity of any reduction of the results obtained."

Moisture determinations, J. H. SHEPPERD and A. M. TEN EYCK (*North Dakota Sta. Bul. 38, pp. 396–402, 405, 406, 409–411, fig. 1, dgms. 2*).—In connection with the comparative tests of methods of culture of wheat, noted elsewhere (see p. 338), determinations of the moisture content and temperature of the soil at different depths were made and observations on the temperature and humidity of the air and on evaporation were recorded.

"Three complete determinations of the moisture content of each plat were made during the season. The first set of samples was taken May 3 to 12, a short time after sowing and before much of the grain was up. A second set of samples was taken July 5 to 9, when the wheat was heading, and the third set was taken August 10 to 15, just after harvest. Part of the first set of samples, including all of the fall-plowed plats except three, were taken with a soil tube made after the pattern of the tube used by Prof. F. H. King, of the Wisconsin Experiment Station. The remaining samples of the first and second sets were taken with a common wood auger.

"Samples were taken with the auger and with the tube from the same plat and the percentage of moisture was compared. The auger samples showed the higher percentage of moisture. The auger method of sampling is preferable with our soil when it is moist and sticky.

"Each sample taken is a triplicate or is a composite from 3 holes made in the same plat. An inch and a quarter auger was used for the first foot and an inch auger for the second and third feet. The samples thus obtained were found to be more nearly equal in bulk and weight than when the larger auger was used for each foot.

"Favorable weather prevailed during the taking of each set of samples. Check samples taken on the last day of sampling from the first plat samples showed very little change in moisture content. The greatest change or loss occurred between July 5 and 9, the time the second set of samples was taken. This was at a time when the grain was using a large quantity of water and a check sample showed a decrease of moisture as follows during the 4 days' interval:

	Per cent.
First foot	1.31
Second foot	1.81
Third foot	No change.

"The soil samples were dried in a large vertical oven over a free gasolin flame. The temperature was maintained at about 110° C. The drying was continued for from 20 to 24 hours, or until the weights were practically constant. It was found that after a sample was thoroughly dry continued heating caused a gradual slight increase in weight. All percentages of moisture are calculated on the dry weights of the soil."

Observations on evaporation were made with a modified Piche evaporometer.

> "The essential features of the instrument are a graduated glass tube which is filled with water and allowed to rest upon a base covered with filter paper into which the water feeds and from which the evaporation takes place. By a comparison of the results given by this evaporometer with those obtained from a freely exposed water surface it was found that the evaporation recorded by the evaporometer exceeded that from the free water surface in the ratio of 1.2:1."

In a special study of the moisture and temperature of the soil under the Campbell and ordinary methods of culture of wheat, daily observations from May 13 to the end of August were made on fall-plowed plats at depths of 3 to 6 and 21 to 24 in., with the electrical apparatus devised by the Division of Soils of this Department.

> "The results seem to be slightly in favor of the Campbell treatment. Under this treatment the 3 to 6 in. depth has maintained more water than the ordinary treatment through the whole season. The drought seems to have been about 2 weeks later in reducing the moisture at 21 to 24 in. under the Campbell treatment than under the ordinary. . . .
>
> "The average moisture content for the whole season shows a difference in favor of the Campbell treatment of 1.84 per cent in the first 6 in. and 0.43 per cent at the 21 to 24 in. depth. . . .
>
> "The temperature at the 3 to 6 in. depth was highest through the whole season in the Campbell plat, the greatest difference, 13°, occurring May 17. The greatest and most rapid changes of temperature also occur in the Campbell ground.
>
> "At the 21 to 24 in. depth . . . the temperature of the 2 plats seldom varies more than 2 or 3°, but the general average for the whole season is in favor of the ordinary treatment. At this depth the soil given ordinary treatment shows greater and slightly more rapid changes of temperature than the Campbell ground. The loose earth of the cultivated plat is subject to great and rapid changes of temperature, but it seems to act as a blanket to keep the heat more uniform in the firmer soil below. . . .
>
> "The mean of the daily temperature for the whole season shows a difference of 7.84° in favor of the Campbell ground at the 3 to 6 in. depth, while at the 21 to 24 in. depth the difference is 1.53° in favor of the ordinary treatment. . . .
>
> "The cultivated ground gets warmer near the surface during the day but cools off more rapidly during the night than does the ground receiving ordinary treatment, while the latter allows more heat to penetrate deep into the soil than does the former."

On the injurious effect of sea water on soils, A. J. SWAVING (*Landw. Vers. Stat., 51 (1899), No. 6, pp. 463–471*).—This is an account of examinations of Holland soils which had been overflowed by the sea. It was found that the soils to a depth of 25 cm. contained from 0.5 to 6.2 parts of chlorin per thousand. In the course of a year the amounts were greatly reduced. The injury to crops on the flooded land was apparently partly due to washing of the soil and the deposition of mud, forming a crust which retarded the washing out of the chlorin and in some cases prevented the germination of seeds.

Salt-water flood of November 29, 1897, T. S. DYMOND and D. HOUSTON (*Jour. Essex Tech. Lab., vol. 3, pp. 173–182*).—Analyses of soils from the coast of Essex flooded by sea water during different lengths of time (6 hours to 8 days) showed the presence of about 0.2

per cent of salt (NaCl) in the surface soil as against 0.01 per cent in unflooded soil, an amount considered insufficient to account for the injury to the crops, since "it has been found that in soil containing as much as 1.6 to 2 per cent of salt, i. e., 20 tons per acre diffused through the first 6 in., barley and annual grasses are able to grow, while the latter will produce a full crop in land containing 1 per cent and that clover will flourish in land containing 0.5 per cent of salt."[1] The injury is believed to be due to the action of the salt on the mechanical condition of the soil.

The removal of the salt from the soil by means of washing and by the growth of crops is discussed, the results of some experiments in these lines being briefly referred to.

The soils of Dorset, D. A. GILCHRIST, C. M. LUXMOORE, and A. M. RYLEY (*Jour. Reading College, 1899, Sup. VIII, pp. 40*).—This is a preliminary report "issued under the terms of an agreement with the Technical Instruction Committee of the Dorset County Council, by which the agricultural department of Reading College has undertaken to analyze 20 samples of soil annually during the 5 years commencing January 1, 1898, making in all 100 samples of soil. Preliminary reports will be published annually, and a full report will be issued at the end of the 5 years."

Analyses of 22 samples of soil from Dorset, besides 2 from Oxon and 1 each from Hampshire and Berkshire, are reported.

> "The districts from which the samples of soil are taken are carefully selected so that the various geological formations in Dorset may be well represented, and also that each may be, as far as possible, typical of a considerable area of land.
>
> "The principal objects of the work are (1) to place in the hands of Dorset agriculturists information as to the composition of the soils of the county, and (2) to make suggestions for the manuring of the principal farm crops on the different classes of soils. The samples of soil are collected by the agricultural lecturers, who note the geological and agricultural characteristics of the soils and subsoils, as well as their suitability for different crops."

The samples were taken in boxes which preserved the soils in their natural condition to a depth of 18 in. The soil and subsoil were separately subjected to mechanical and chemical analysis by the usual methods. The phosphoric acid and potash soluble in citric acid by the Dyer method were also determined. "There is no simple relation yet apparent between the richness or poverty of a soil in potash or in phosphates, total or soluble, and the geological formation on which it lies." Lime in state of carbonate is distinguished from that in other combinations.

The results are discussed with reference to "the manuring of the principal farm crops on the different classes of soils."

Potable water, C. W. MCCURDY and T. SMITH (*Idaho Sta. Bul. 19, pp. 67-76*).—The importance of a pure water supply is briefly discussed, directions are given for taking samples of water for analysis, and analyses of 1 sample of artesian water

---

[1] Proc. Inst. Civil. Eng., 101 (1890), pp. 189-204.

(with reference to sanitary condition and mineral constituents) and 20 samples of well water (with reference to sanitary condition) are reported, with notes on interpretation of the results of analysis.

The industrial sterilization of potable water by means of ozone (*Rev. Sci. [Paris], 4. ser., 12 (1899), No. 14, pp. 432-435*).—A review of work on this subject.

Drinking water—city, town, and rural supplies, A. W. BLAIR (*North Carolina Sta. Bul. 161, pp. 207-223, fig. 1*).—This bulletin reports analyses with reference to sanitary conditions of 88 samples of drinking water and discusses in a popular manner the purity and solvent properties of water; sources of drinking water; the construction and care of wells; the relation of drinking water to disease, and the value of chemical analysis in determining the sanitary condition of water. Directions for sampling drinking water are added.

Drinking water, J. L. HILLS, B. O. WHITE, and C. H. JONES (*Vermont Sta. Rpt. 1898, pp. 177, 178*).—Analyses, with reference to purity, of 56 samples classified as follows: Springs, 20; wells, 27; reservoirs, 5, and pond ice, 4. "The analyses show that 25 per cent of the spring water, 30 per cent of the well water, 40 per cent of the reservoir water, and all of the ices were either impure and unfit to use or else were of doubtful purity. There have been 231 samples of water analyzed at this station during the past 5 years. The proportions of questionable samples in the various groups have been found to be, spring, 22 per cent; well, 50 per cent; pond, etc., 41 per cent. It is but fair to say, however, that in several cases there was reason to believe that the sample was made impure by the use of a dirty jug, bottle, or can."

Essential soil constituents, T. S. DYMOND (*Jour. Essex Tech. Lab., vol. 3, pp. 11-15, dgm. 1*).—A table and diagram show the total and available amounts of lime, magnesia, potash, phosphoric acid, sulphuric acid, and nitrogen in average Essex soils, and the amounts absorbed by crops, lost in drainage, and applied in fertilizers and manure.

Soils of Mississippi—texture and water conditions, W. L. HUTCHINSON (*Mississippi Sta. Bul. 58, pp. 14*).—A popular general discussion of this subject.

Analysis of soils, C. F. JURITZ (*Rpt. Senior Analyst Cape of Good Hope, 1898, pp. 36-50, chart 1*).—Results of examinations of some 50 samples of soil are reported and the available plant food in grain soils of 3 different divisions of the province is shown in a colored chart. The results of studies of hillock and level soil here reported have been previously noted (E. S. R., 10, p. 827).

The presence of zinc in the soil and the products of the soil, from different parts of the province of Liege, JOURISSEN and PROST (*Bul. Assoc. Belge Chim., 16 (1899), No. 6, pp. 272-278*).—Notable quantities of zinc were found in both the soil and vegetation, even at a distance of 22 kilometers from zinc works. The methods employed for the separation and determination of zinc are given.—H. SNYDER.

FERTILIZERS.

The availability of organic nitrogen in fertilizers as measured by the alkaline-permanganate method, C. H. JONES (*Vermont Sta. Rpt. 1898, pp. 160-171*).—Nine modifications of the permanganate method were tested on 18 nitrogenous materials. "The results of these preliminary trials with the various acid, alkaline, and neutral permanganates indicated that comparisons of the nitrogen availabilities of different substances would probably be more reliable if equivalent amounts of nitrogen were used than if a gram of substance, be it rich or poor in this element, was taken." The experiments on this point, using acid and alkaline-permanganate solutions, gave results more comparable with each other than those obtained by using 1 gm. of material for each determination.

"A consideration of the results obtained, rapidity and ease of handling, led to the selection of the alkaline-permanganate method (using 16 gm. potassium permanganate and 150 gm. sodium hydrate to a liter) for further work on a nitrogen equivalent basis of about 4.50 per cent (0.045 gm.)."

The results obtained were as follows:

Nitrogen availabilities as shown by the alkaline-permanganate method.

	Materials.	Total nitrogen.	Using 1 gm. of substance.		Using 0.045 gm. nitrogen.			
			Nitrogen available.	Availability of nitrogen.	Substance used.	Nitrogen equivalent.	Nitrogen available.	Availability of nitrogen.
		Per cent.	*Per cent.*	*Per cent.*	*Gms.*	*Per cent.*	*Per cent.*	*Per cent.*
1	Ground bone	3.33	2.42	72.6	1.333	4.44	2.94	66.2
2	Dried fish	6.93	3.15	45.5	.666	4.62	3.16	68.5
3	Tankage	5.18	2.31	44.6	.900	4.66	2.61	56.0
4	Cotton seed meal	6.90	1.81	26.4	.666	4.60	2.13	46.3
5	Dried blood	13.71	3.95	28 8	.333	4.57	3.12	68.3
6	Castor pomace	5.70	2 52	44.2	.800	4.56	2.73	60.0
7	Leather	7.51	1.16	15.6	.600	4.50	1.47	32.7
8	Hoof meal	13.65	4.55	33.3	.333	4.55	3.11	68.3
9	Horn meal	14.53	4.49	30.9	.310	4.50	2.67	59.4
10	Horn shavings	14.39	4 65	32 3	.310	4.46	2.88	64 6
11	Leather refuse	7.29	1.43	19.5	.610	4.45	1.33	30.0
12	Philadelphia tankage	7.07	1 23	17.4	.620	4.38	1.30	29.7
13	Felt refuse	4.55	2.24	49.2	1.000	4.55	2.31	50.8
14	Wool waste	4.94	1.71	34 5	.900	4.45	1.82	41.0
15	Casein	12.36	3.30	26.7	.360	4.45	2.59	58.2
16	Flax meal	6.41	2 17	33.8	.700	4.49	2.03	45.2
17	Gluten meal	6.55	1.76	26.5	.680	4.52	2.09	46.0
18	Muck	1.57	.52	33.0	2.800	4.40	.94	21.3

"It would appear from the table that 1 gm. of highly organic materials is too large an amount to subject to the disintegrating effect of a solution containing 1.6 gm. of potassium permanganate and 15 gm. of sodium hydrate under the specified conditions [digesting below boiling 1 hour and distilling 1 hour]. Its use gives low and obviously unsatisfactory figures. Thus the nitrogen of cotton-seed meal and of dried blood, which is known to be readily available in the soil, ranks lower in apparent availability than that of wool waste and muck, which is actually relatively inert. Indeed it does not rise far above that of the leather products. When, however, equal quantities of nitrogen rather than of the crude material are treated, a different and more rational story is told.

"Grouping the crude stock according as it falls one side or the other of 50 per cent availability when thus tested, the following showing is made:

"*Above 50.*—Dry ground fish, dried blood, hoof meal, ground bone, horn shavings, castor pomace, horn meal, casein, tankage, felt refuse (68.5 to 50.8).

"*Below 50 and above 40.*—Cotton-seed meal, gluten meal, flax meal, wool waste (46.3 to 41.0).

"*Below 40.*—Raw leather. leather refuse, Philadelphia tankage, muck (32.7 to 21.3).

"The only questionable stock in the first group is the felt refuse.

"All the materials in the third group are well known to be of inferior availability.

"The second group is an anomalous one. The nitrogen of cotton-seed and linseed meals is, as a matter of fact, readily available in the soil, yet 8 samples of cotton-seed meal tested on the 4.50 per cent nitrogen basis show low availabilities ranging from 46 to 49 per cent.

"It seems probable that these low figures are caused by the relatively large amounts of nonnitrogenous organic matter which these goods contain. This theory is borne out by the similarity of the results obtained with other vegetable ammoniates (flax and gluten meals), although castor pomace is an exception. It is also confirmed by the lowered results obtained on dried blood, dry ground fish, etc., when nonnitrogenous organic matter (filter paper, starch, etc.) were digested with them in the permanganate solutions. . . .

"The shortcoming of the permanganate method does not seriously impair its usefulness, inasmuch as pepsin-digestion methods accord to materials like unacidified cotton-seed meal their just dues. Doubtful samples should not be condemned on the testimony of a single method. Any fertilizer containing nitrogen with low availability by permanganate, but ranking relatively high by pepsin, may be passed with a fair degree of safety."

The alkaline-permanganate method and the pepsin-digestion method were compared on 118 brands of commercial fertilizers and on the average goods of each of 18 manufacturers selling fertilizers in Vermont. Of the 118 samples 11 showed an availability below 50 per cent and 1 below 40 per cent. Of the 18 average samples 2 seemed to be open to question as regards the quality of the nitrogenous matter.

In conclusion it is stated that—

"The alkaline-permanganate method (16 gm. potassium permanganate, 150 gm. sodium hydrate to 1,000 cc.; 100 cc. used in 600 cc. flask; digestion for an hour below boiling, followed by an hour's distillation) has shown broad distinctions between materials of animal origin of high and low nitrogen availability, provided amounts of substance equivalent to 0.045 gm. of nitrogen are used.

"It is simpler and far more rapid than the pepsin-digestion method, and should prove particularly useful in eliminating quickly from a long list of fertilizers a large share of goods which would surely show high availabilities by the longer and more tedious processes. Its failure to show a sufficient availability with unacidified vegetable ammoniates may be overcome by the use of the pepsin method in doubtful cases.

"Materials falling below 50 per cent nitrogen availability by this method are open to suspicion; those falling below 40 per cent are surely of little value for the production of crops. All such, however, should be likewise tested with pepsin, and, if opportunity admits, may be subjected to vegetation tests.

"The alkaline-permanganate method should be considered an aid to vegetation tests rather than a substitute for them."

The use of ammoniacal fertilizers on calcareous soils, E. Giustiniani (*Ann. Agron.*, *25* (*1899*), *No. 7*, *pp. 325-335*).—This is the first of a proposed series of articles on this subject and deals with experiments made with sand. The experiments were made in 250 cc. bottles containing 200 gm. of sand mixed with varying amounts of calcium carbonate. For purposes of comparison one bottle contained pure sand; another, pure calcium carbonate. A known quantity of ammonium sulphate solution was added and the amount of ammonia which escaped was determined by drawing a current of air through the soil and passing it through acid. In one series of experiments moist air was used; in another, dry air. Experiments of the same character, using only moist air, were made with Thomas slag as a substitute for the calcium carbonate. In the first case the bottles were allowed to stand closed and at rest for 48 hours; a current of moist air drawn through them during 48 hours removed about ½ of the ammoniacal nitrogen added. The amount of calcium carbonate present was practically without effect on the amount of ammonia removed. With dry air, however, nearly the whole of the nitrogen was given off. With Thomas slag the evolution of ammonia was more rapid. In the case of the sand containing 3 per cent of slag, nearly all of the nitrogen was removed in 20 hours.

The preservation of manure, M. Maercker (*Landw. Wohnschr. Sachsen, 1899, No. 1; Neue Ztschr. Rübenz. Ind., 42 (1899), No. 15, pp. 161–163*).

The work of bacteria in barnyard manure, A. Stutzer (*Die Arbeit der Bakterien im Stalldünger. Berlin: Paul Parey, 1899, pp. 28*).

Fertilizers—a guide for instruction in agricultural schools, H. Balster (*Düngerlehre, ein Leitfaden für den Unterricht in der Düngerlehre an landwirtschaftlichen Lehrenstalten. Stuttgart: Eugen Ulmer, 1899, pp. 82*).

A review of the present knowledge of sodium nitrate, together with the origin, production, and destruction of nitrates in the soil, J. A. Myers (*Jour. Amer. Chem. Soc., 21 (1899), No. 5, pp. 455–468*).—This is an extended résumé of the subject, treating especially of the agricultural features.

Wiborgh phosphate, L. F. Nilson (*Landw. Vers. Stat., 51 (1899), No. 6, pp. 401–420*).—This article has already been noted from another source (E. S. R., 10, p. 32).

The phosphates of Gard, J. Pellissier (*Jour. Agr. Prat., 1899, II, No. 40, pp. 496–499*).—A description of the deposits and of the nature of the phosphates.

Arsenic in superphosphates, E. Haselhoff (*Landw. Wchnbl. Schleswig-Holstein, 49 (1899), No. 34, pp. 637–639*).

Influence on plants of potassium perchlorate in nitrates, A. Pagnoul (*Belg. Hort. et Agr., 11 (1899), No. 16, pp. 249, 250*).

Fertilizers and fertility, L. A. Clinton (*Amer. Gard., 20 (1899), No. 249, p. 670*).—A discussion and attempt at explanation of the results obtained in certain fertilizer tests on field crops in which the fertilized plats gave decreased yields as compared with control plats which received no fertilizers.

FIELD CROPS.

Crop report for 1898, J. H. Shepperd and A. M. Ten Eyck (*North Dakota Sta. Bul. 39, pp. 413–458, figs. 3*).—The work here reported consists of variety tests and a study of the thickness and depth of planting of grain, forage, and root crops; a test of changing seed wheat; and a series of experiments in crop rotation. Work along this line has been previously reported (E. S. R., 8, p. 214). No results have been published for 1896 and 1897. This report deals mainly with crops grown in 1898. The results are given in tables and discussed.

Among 39 varieties of wheat tested this season, Select Haynes Blue Stem and Select Rysting Fife, both originated from selected plants, stood highest in grade and yield. For a series of 5 years Bolton Blue Stem gave the largest average yield, and for a series of 7 years Experiment Station Fife 66 stood first in yield and grade.

Experiments in changing seed indicated that the practice is beneficial only when a better variety or a better strain of the same variety are obtained.

Sowing wheat at the rate of 5½ pk. per acre gave the best average results for 4 seasons. This season, sowing at different depths had but little effect on the yield. Sowing from 2 to 3 in. deep is considered best.

Of a number of varieties of oats, Tartarian gave the best yields in the 5 years' test. Sowing from 5 to 10 pk. of oats per acre influenced the yield but little during this season.

The results of 4 years' tests showed that Mansury barley was the most prolific of the varieties tested. The results of a single trial showed that sowing barley at a depth of 3 in. gave the best yield.

Tests with spelt indicated that it produces as large a yield as barley, and analyses showed that it is equal in feeding value to barley or oats.

Corn did not mature at the station this season, and Kafir corn has not matured in any season. Gehu, Will Acme, Will Dakota, Mercer, and Northwestern Dent are considered as some of the best varieties for that locality. Sowing corn broadcast gave smaller yields than sowing it in drills. Corn sown in drills 24 in. apart gave better yields than at greater or less distances. Planting in drills 3½ ft. apart produced the largest yields of grain and fodder when single plants stood 6 in. apart in the drill. This season planting from 2 to 4 in. deep gave the best results.

Owing to the short season only the earliest varieties of potatoes ripened in 1898. In a single trial Early Andes gave the best yield and was found to equal Early Ohio in quality and earliness. Planting in hills 10 in. apart with rows 3½ ft. apart resulted in best yields in a series of distance experiments carried on this season. Doubling the amount of seed in the hill was not found profitable. A single trial indicated that planting potatoes from 4 to 5 in. deep gave the best results at the station.

Rotation experiments carried on for 6 years showed that continuous wheat culture is unprofitable and that growing wheat in rotation increases the yield and improves the quality. Land producing 3 crops of wheat and 1 cultivated crop in 4 years gave almost as much wheat and more profitable returns than land producing 4 crops of wheat in succession.

Rye has not proved a profitable crop at the station. Early varieties of buckwheat are considered valuable for the eastern part of the State.

Report of the experiments in the manuring of oats, hay, turnips, and potatoes, R. P. WRIGHT, J. W. PATERSON, and J. R. CAMPBELL (*Glasgow and West of Scotland Tech. Col. Agr. Dept. Rpts. 1897, pp. 116*).—It is concluded from tests on the residual value of manures applied to the turnip crop, as shown in the effect of succeeding oat and hay crops, that applications of the common phosphatic fertilizers and barnyard manure extend their influence over several crops. Superphosphate gave better returns than basic slag or bone meal, considering both the immediate and subsequent effects. Bone meal was inferior to basic slag. Better yields were obtained from an application of 10 tons of barnyard manure and 4 cwt. of superphosphate than from an application of 20 tons of barnyard manure alone.

The results of experiments on the manuring of turnips in 1897 indicated that barnyard manure should be applied with superphosphate. The nitrogen and phosphates of dissolved bones were less effective than the same substances supplied in mineral superphosphate in conjunction with sulphate of ammonia and nitrate of soda. Kainit gave better results than sulphate of potash when applied with superphosphate and nitrate of soda.

From results in manuring hay fields the author concludes that the relative proportion of grasses and clovers in the hay can be largely controlled by the fertilizers applied. Better results were obtained from the barnyard manure when a nitrogenous fertilizer was applied with it.

The results of fertilizer experiments with oats during the season of 1897 showed that the application mixed in the proportion of 1 cwt. nitrate of soda and 2 cwt. each of superphosphate and kainit was most effective. Omitting potash from the application or doubling the amount of kainit in the formula given above was found to be detrimental. The results further indicate that the quantity of superphosphate might be increased with advantage, and that sulphate of ammonia could be wholly or partially substituted for nitrate of soda.

In experiments on the manuring of early potatoes the best results were obtained from a fertilizer containing 17 per cent soluble phosphate, 4.75 per cent ammonia, and 9.75 per cent potash. From the data obtained, the author concludes that potatoes require a complete fertilizer.

A rotation experiment has been in progress for 2 years and is to be continued another season. The object of the work is to determine the relative merits of large quantities of slow-acting fertilizers applied only once in the rotation and of smaller dressings of quick-acting fertilizers applied to each successive crop. The results so far are in favor of the quick-acting fertilizers.

The growth of alfalfa in Kansas, G. L. Clothier (*Kansas Sta. Bul. 85, pp. 1–13*).—This is a report upon observations on the growth of alfalfa in 27 counties of northwestern Kansas. A synopsis of interviews with 51 farmers concerning the raising and use of alfalfa is given.

> "The ideal conditions of soil and moisture for the growth of the plant are found in the valleys of streams where sheet water is obtained at the depth of 20 ft. or less and where the soil is a porous, sandy loam with a permeable subsoil. I am convinced, however, that alfalfa will grow and give remunerative returns upon as many varieties of soil as any other cultivated plant. . . . It will produce a fair crop . . . upon poor land if not water-soaked. . . . Sufficient moisture in the soil is the one condition indispensable to a good crop of alfalfa."

The feeding value of green alfalfa and alfalfa hay is discussed. The author notes that alfalfa hay, even when well cured, is liable to become moldy. As a remedy it is recommended that the hay be stacked with alternate layers of straw in the proportion of 2 loads of alfalfa to 1 of straw. The dangers attending pasturing animals on alfalfa are discussed, as well as the profits from feeding this crop.

The grafting of beets, M. H. Sagnier (*Bul. Soc. Nat. Agr. France, 59 (1899), No. 7, pp. 520–523*).—The grafting of sugar beet for the purpose of increasing the seed yield of desirable varieties is described. A beet from which it is desired to obtain a large yield of seed is sprouted. As soon as the offsets at the crown of the beet have reached 2 or 3 cm. in length they are removed, along with a small portion of the flesh, and grafted on another beet. This is done by inserting the offset on a new beet just below the crown in a cut corresponding to the form of the piece of flesh taken from the mother beet. It is reported that in one experiment 48 offsets were obtained from one mother beet in this manner, 31 of which, when grafted on other beets, grew and produced first-class plants, each plant yielding a normal amount of seed.

Cassava—cultural notes and fertilizer experiments, H. E. Stockbridge (*Florida Sta. Bul. 49, pp. 5–19, pls. 2, fig. 1*).—Notes are given on the origin, habitat, and characteristics of the cassava plant and the soil and climatic conditions it requires. Methods of preserving and planting the seed, preparing and fertilizing the soil, and cultivating and harvesting the crop are described.

The fertilizer experiment was conducted on 9 fifth-acre plats. A fertilizer mixture consisting of 125 lbs. acid phosphate, 150 lbs. cotton-seed meal, and 75 lbs. muriate of potash per acre, which has given good results at the station, was considered a normal application, and in this test the fertilizer applications were modifications of one or more of the constituents of this normal fertilizer.

Yield of cassava roots per acre with different fertilizers.

	Pounds.
Check plat—no fertilizer	7,420
250 lbs. acid phosphate, 300 lbs. cotton-seed meal, and 150 lbs. muriate of potash	10,430
187½ lbs. acid phosphate, 225 lbs. cotton-seed meal, and 112½ lbs. muriate of potash	11,480
125 lbs. acid phosphate, 150 lbs. cotton-seed meal, and 75 lbs. muriate of potash	13,510
125 lbs. acid phosphate, 150 lbs. cotton-seed meal, and 37½ lbs. muriate of potash	15,050
125 lbs. acid phosphate, 75 lbs. cotton-seed meal, and 75 lbs. muriate of potash	15,080
62½ lbs. acid phosphate, 150 lbs. cotton-seed meal, and 75 lbs. muriate of potash	12,250
250 lbs. acid phosphate, 300 lbs. cotton-seed meal, and 150 lbs. muriate of potash	13,475
250 lbs. acid phosphate, 300 lbs. cotton-seed meal, and 150 lbs. muriate of potash	12,740

The average yield of cassava on the 8 fertilized plats was 12,979 lbs., the smallest yield being 10,430 lbs. and the largest 15,080 lbs. As the experiment covers only a one-year trial, the author draws no definite conclusions.

Field experiments with corn, W. C. LATTA and W. B. ANDERSON (*Indiana Sta. Bul. 77, pp. 29–34*).—These experiments are in continuation of work formerly reported (E. S. R., 9, p. 237). This is the seventh year of the experiments. A summary of the average results is here given.

In general, planting corn early in May gave the best returns. The greatest average yields of ears and stalks were obtained when single stalks stood 12 to 14 in. apart in rows 3½ ft. apart. Thick planting reduced the size of the ears and the percentage of grain, but in dry seasons it produced the heaviest yield of stalks. Cultivating 1, 2, and 3 in. deep gave about equal results, and cultivating 4 in. deep considerably reduced the yield. There was practically no difference in planting corn in hills or drills.

The fertilizer tests showed that in continuous corn culture heavy applications of manure and commercial fertilizers were not profitable. A "heavy" application of commercial fertilizers consisted of 250 lbs. of acid phosphate, 432 lbs. ammonium sulphate, and 105 lbs. muriate of potash, and a "heavy" application of horse manure of 14,500 lbs. per acre. It was noticed that the effect of a heavy dressing of fresh horse manure was not exhausted after 15 years of continuous corn culture.

A number of different cultural implements have been under trial for several years, but their use has given nearly equal yields of corn. The spring-tooth cultivator is preferred for the station farm, which has a dark compact loam soil with natural drainage.

Culture of corn forage in Princes Park, L. GRANDEAU (*Jour. Agr. Prat., 1899, II, No. 36, pp. 333–335*).—A record is given of experiments made to determine the effects on corn of fertilizing at seed time with large amounts of potash salts, and also to determine the relative values of different forms of nitrogen for corn.

The experimental field was divided into 16 plats and the whole planted to corn in rows 0.40 meter apart and at the rate of 95 kg. per hectare, May 4. Two plats were used as checks. Each of the remaining plats was divided into 2 equal parts, one-half receiving potash salts at the rate of 200 kg. per hectare and the other half at the rate of 400 kg. per hectare in each instance. Phosphatic fertilizers of different origin were added to some of the plats, while others received nitrogen in the form of nitrate of soda, sulphate of ammonia, or dried blood.

The yields of the different plats are tabulated and compared. In every instance the yield was less with potash at the rate of 400 kg. per hectare than with half that amount, the average difference for all the plats being 3,287 kg. per hectare. On the portions receiving the smaller amount of potash, nitrate of soda gave 6,200 kg. per hectare of forage more than sulphate of ammonia and 12,800 kg. more than dried blood. This work, carried on in 1897, is being continued in 1899.

Effect of fertilization upon the composition of crops, J. L. Hills, B. O. White, and C. H. Jones (*Vermont Sta. Rpt. 1898, pp. 145–155, 182–188*).—The results of investigations on this subject with corn and potatoes during 1896 and 1897 are reported.

The experiments with corn were made on $\frac{2}{7}$-acre plats of fairly uniform medium clay loam soil which had been in grass and had not been fertilized for many years prior to the experiment. Three plats were left unfertilized. One received a liberal application of barnyard manure; and four others were fertilized with mixtures of nitrate of soda, tankage, and acid phosphate with muriate of potash and sulphate of potash, and of bone meal with muriate of potash and sulphate of potash.

"The design of the test was to compare the yields and composition of corn grown for a series of years without fertilization after the first year, noting the effects—and particularly the residual effects—of phosphoric acid from acid phosphate and from bone meal, and of potash from muriate and from sulphate. As nearly as might be, equal quantities of nitrogen, phosphoric acid, and potash were used on each plat."

The crop on each plat was carefully sampled and analyzed with reference to food and fertilizer constituents. The results which are reported in detail show that the composition of the crop was slightly but not materially affected by the fertilizers applied. The crop liberally fertilized with barnyard manure contained less dry matter and nitrogen-free extract and more ash, protein, and potash than those otherwise fertilized or left unmanured. The barnyard manure apparently increased the yield but retarded maturity more than the commercial fertilizers.

"In 1896 the crops from fertilized areas were richer in protein and potash than those from unfertilized plats. No such difference (except with the crop grown on barnyard manure) was noticeable the second year. There was a tendency toward high phosphoric acid figures in the crops on the plats to which bone meal had been applied. The plats receiving acid phosphate, tankage, nitrate and potash salts grew crops containing more ash and protein but less nitrogen-free extract than did those receiving bone meal and potash salts. No differences were noted which might be ascribed to the use of sulphate instead of muriate of potash."

In the experiments with potatoes, 3 sets of plats ($\frac{1}{60}$, $\frac{1}{30}$, and $\frac{1}{20}$ acre in size) were used; 2 sets on sandy loam soil which had been well manured in previous years, and 1 on greensward which had not been fertilized for many years. Three plats received no fertilizer; 2 received acid phosphate and muriate of potash; 2 acid phosphate and sulphate of potash; 2 acid phosphate, muriate of potash, and nitrate of soda; 2 acid phosphate, sulphate of potash, and nitrate of soda; and 2 barnyard manure. The product of each crop was carefully sampled and analyzed, the results of the analyses of 114 samples being reported. The results are summarized as follows:

"The unfertilized crops carried the most dry matter and nitrogen-free extract.

"The crops grown on barnyard manure contained notably more phosphoric acid than did the others.

"The muriate-grown crops contained less dry matter and less nitrogen-free extract than those grown with sulphate of potash.

"The nitrate-grown crops contained less dry matter and more protein than those not thus fertilized.

"The minor constituents fluctuated within narrow limits, and were unaffected by changes in manuring.

"In general, fertilization tended to depress the percentages of dry matter and of starch, and, to a slight degree, to raise those of ash."

Culture experiments with potatoes and beets at Grignon in 1898, P. P. DEHÉRAIN (*Ann. Agron., 25 (1899), No. 7, pp. 336–350*).—The work reported comprises variety and fertilizer tests. Of 5 varieties of potatoes tested, Dr. Lucius was richest in starch, containing 21.9 per cent. Seed of Richter Imperator obtained from 2 different sources produced tubers which varied 2 per cent in starch content. The results for all varieties are given in the following table:

Yield of tubers, dry matter, and starch per hectare of different varieties of potatoes.

Variety.	Tubers.	Dry matter.	Starch.
	Kgs.	*Kgs.*	*Kgs.*
Dr. Lucius	28, 400	7, 845	6, 183
Prof. Maercker	28, 250	7, 484	5, 844
Richter Imperator (Vilmorin)	27, 900	7, 475	5, 857
Richter Imperator (Grignon)	25, 450	6, 359	4, 906
Variété Poulet	18, 550	4, 968	3, 892
Géaute Bleue	17, 300	2, 646	1, 857

Two varieties of forage beets were grown with about equal results. The beets contained 12.4 per cent of sugar and over 19 per cent of dry matter. With the results in view the author suggests that the large coarse growing forage beets be replaced by a beet smaller in size and containing less water and potassium nitrate and more sugar.

Sugar beets in Colorado in 1898, W. W. COOKE (*Colorado Sta. Bul. 51, pp. 43*).—This gives the results of culture experiments, of variety and seed tests, and of competitive tests in growing sugar beets on a commercial scale. The general result of the season's work has demonstrated the ability of Colorado to produce sugar beets profitably, and further work along these lines will be confined to cultural problems and to special features of the industry.

Samples of all the beets grown in 1898 were taken the last of September and again October 22. These showed an average sugar content of 15.43 per cent in the beet and a purity of 78.6 for the first samples, and 16.38 per cent sugar and 78.1 per cent purity for the second samples.

The data for the different experiments including analyses of the beets are given in tabular form and commented upon. At the home station beets planted June 15 produced less than half as much sugar per acre as beets planted May 10, 13, or 27; and beets planted at the Rockyford Substation April 18 gave a larger yield of pure sugar per acre than those planted May 2, 16, or June 1, though the quality of the beets from the latter planting was somewhat better than from the first. Beets planted in ground freshly plowed gave better results as regards germination, sugar, purity, and yield than when planted 3 days after the ground had been plowed. Irrigation of the seed at time of planting did not show any special benefit on heavy ground, but is believed desirable and even necessary on light soils. Soaking beet seed in water for 24 hours before planting resulted in neither advantage nor disadvantage from the practice. In an experiment on planting seed at different depths, results were practically the same whether the seed was planted ½, 1, or 1½ in. deep. Beets planted with a hand drill at the bottom of a 3-in. furrow showed no advantage over level culture. Transplanting beets resulted in every instance in producing fibrous and ill-shaped roots, although the yield and quality of the beets did not seem to be materially affected. The method, however, was not financially profitable. Thinning beets to distances from 4 to 10 in. in the row seemed to have but little effect on the quality of the crop, but the yield was greater with beets less than 8 in. in the row than over this distance. Different dates of thinning had but little influence on the crop, and the author believes that the work of thinning can be extended over a period of 2 weeks without injury to the beets. Heavy rains rendered the test of different numbers of irrigations inconclusive.

Beet seed grown in Utah and New Mexico was compared with seed grown in France and Germany. The experiment was made on small plats and under commercial conditions in coöperation with farmers in different parts of the irrigated districts of Colorado. The American-grown seed was of the Kleinwanzlebener variety. This was compared with Vilmorin seed from France, Mangold from Saxony, and Kleinwanzlebener from Germany. The results, which are shown in tables, were in favor of the Utah-grown seed as regards the percentage of sugar and purity, while the yield per acre was equal to that from the other seed. New Mexico seed gave as good results as the French seed, but not as good as the German seed. The author states that "in the light of these experiments there can be no doubt that sugar-beet seed can be grown in the United States fully equal to the best imported seed."

During the campaign of 1898, 9 carloads of beets grown on a commercial scale by different growers in the vicinity of Loveland, Colorado, were shipped to a sugar-beet factory at Grand Island, Nebraska. The average yield of the beets, as shown by available data, was a little less than 19 tons per acre, and the sugar yield about 5,300 lbs. per acre. Data for shipment of sugar beets from Grand Junction, Colorado, to the sugar factory at Lehi, Utah, in 1893 and 1894 are also recorded, as is data for sugar beets grown in different parts of the State in competition for cash prizes offered by various organizations in 10 counties.

Cultivation experiments with wheat, J. H. SHEPPERD and A. M. TEN EYCK (*North Dakota Sta. Bul. 38, pp. 383–396*).—A record of the second season of this experiment (E. S. R., 9, p. 931). Three fourth-acre plats were added this year, making a total of 63 plats in the series.

The results are given in tabular form, and the weather conditions and crop growth during the trial are described.

The author gives the following summary of results, which are in most cases the average of two seasons, and which are not given as absolute conclusions:

"Wheat sown in drills and cultivated gave a yield of 10 bu. and 12 lbs. less per acre than wheat sown in the ordinary way.

"Fall-plowed land gave 1 bu. per acre heavier yield than spring plowing, as an average for 7 years' trial. Deep plowing gave 43 lbs. greater yield per acre than shallow, and 37 cts. greater net profit. Ground plowed with the Secretary disk gang plow yielded 50 lbs. less per acre than that plowed with an ordinary moldboard plow. Subsoiled land gave an increase of 54 lbs. per acre, but at greater cost, making the net profits 42 cts. less per acre upon subsoiled land. Land subsurface packed gave 1 bu. and 6 lbs. greater yield than land not packed, and 61 cts. greater net profit per acre.

"Rolling and harrowing land after seeding gave an increase of 3 bu. and 11 lbs. per acre in yield and $1.25 in net profit, as a result of a single trial in the season of 1898. Harrowing wheat 1 week after seeding caused an increase in yield of 2 bu. and 1 lb. and an increase in net profit of 72 cts. per acre. Harrowing land immediately after plowing gave an increase of 39 lbs. per acre in yield and an increase in net profit of 25 cts. per acre."

Report of the agricultural section, W. W. COOKE (*Colorado Sta. Rpt. 1898, pp. 143-159, pls. 2*).—This report reviews the work for the season of 1898, and is devoted mainly to the cooperative work with sugar beets carried on in those sections of the State which seem adapted to the crop. The results of the work are given in tables by counties. The average results showed a yield of over 20 tons of beets per acre, with a sugar content of 15.43 per cent and a coefficient of purity of 80.8.

Field experiments at the Arkansas Valley Experiment Station, H. H. GRIFFIN (*Colorado Sta. Rpt. 1898, pp. 220-224*).—The results of experiments with field crops, comprising culture and variety tests with wheat, corn, and grass and other forage crops during 1898, are briefly summarized in a popular manner.

Field tests at the Rainbelt Experiment Station, J. E. PAYNE (*Colorado Sta. Rpt. 1898, pp. 206-211*).—California barley, *Bromus inermis*, alfalfa, nonsaccharine sorghums, cowpeas, Canada field peas, Idaho peas, and a number of varieties of corn were grown experimentally, and the yields are here reported. Gypsum applied at the rate of 1,000 lbs. per acre gave a large increase in the yield of Early Amber cane. The Campbell method of soil culture was tested in connection with growing cereals, sorghums, corn, and potatoes, and in the majority of cases the results were favorable to ground packed according to this method.

Florida beggar weed, J. G. SMITH (*U. S. Dept. Agr., Division of Agrostology Circ. 13, pp. 5, figs. 2*).—This circular gives a brief description of the Florida beggar weed (*Desmodium tortuosum*), discusses its value as a fertilizer and as a hay and forage crop, and gives directions for its culture.

Grass and forage crops, J. H. SHEPPERD (*North Dakota Sta. Bul. 40, pp. 459-470*).—This bulletin summarizes briefly the results of growing various forage crops in North Dakota and in adjoining States and provinces. In connection with the notes cultural methods are described and recommended. Awnless brome grass, timothy, redtop, the native prairie grasses, field peas, hairy or sand vetch, and rape gave promising results, while the experiences with orchard grass, alfalfa, melilot, cowpeas, spurry, and the different varieties of clover were not encouraging.

Experiments on pasture, E. K. (*Agr. Students' Gaz., 9 (1899), No. 4, pp. 111-113*).—Tabulated record of 20 fertilizers used on twentieth-acre pasture plats and the yields of fertilized over unfertilized plats. Phosphatic manures encouraged the growth of clovers. Sulphate of ammonia proved superior to nitrate of soda. "The plat fertilized with superphosphate and nitrate of soda gave the highest yield, but all the plats receiving superphosphate with either nitrate or sulphate of ammonia gave good crops, the increase being from 15 to 19 cwt. over the unmanured."

Results of two years' experiments on the Kemp meadows, near Novo-Alexandri, in the Lublin Government, M. P. SOLONENKO (*Zap. Novo-Alexandri Inst. Selsk. Khoz. i Lyesov., 11 (1898), No. 3, pp. 43-50*).—The influence of fertilizing on the yield of meadow grasses was studied.—P. FIREMAN.

The manuring of hops, H. H. COUSIN (*Agr. Gaz. [London], 50 (1899), No. 1343, pp. 216, 217.*)—Popular discussion of the value and use of phosphates as hop manures.

Mangel-wurzels and the cost of production, H. E. VAN NORMAN (*Indiana Sta. Bul. 77, pp. 35-37*).—Two acres of mangel-wurzels were grown experimentally and the cost of growing the crop determined. The methods of culture and storing are described. Giant Yellow Intermediate yielded 25.25 tons; Champion Yellow Globe, 24.5 tons; Golden Tankard, 17 tons; and Mammoth Long Red, 16.5 tons per acre. The average cost of growing mangels was found to be $1.04 per ton, while the cost of the largest yield was only 85 cts. per ton.

Potato culture, Z. QUINCEY (*Pacific Rural Press, 58 (1899), No. 15, pp. 228, 229*).—A paper read before the University Farmers' Institute, in which the subjects of soil, soil preparation, seed, planting, and cultivation are discussed.

Manuring of potatoes, W. L. SUMMERS (*Jour. Agr. and Ind. South Australia, 3 (1899), No. 1, pp. 11-14*).—Brief summarization of the results of recent fertilizer experiments on potatoes in New York, Georgia, and the Victorian Department of Agriculture.

Large amounts of complete fertilizers for potatoes (*Bul. [Min. Agr. France], 18 (1899), No. 3, pp. 469, 470*).—The profitableness of heavily fertilizing potatoes with commercial fertilizers on soil somewhat exhausted by having borne a crop of potatoes the preceding season without manure was investigated. The results are not entirely satisfactory owing to the fact that somewhat larger amounts of fertilizers were applied than were necessary. They seem to show, however, the harmful effects of applying potash salts on potatoes near planting time, and the more injurious effects of silicate over sulphate of potash when applied at this time.

Ramie, or China grass, W. SOUTTER (*Queensland Agr. Jour., 4 (1899), No. 5, pp. 380-382, figs. 2*).—This fiber plant is figured and described, the Gomess process for separating the fibers and eliminating the resins noted, and suggestions given as to propagation, culture, and the application of fertilizers.

Rape as a forage crop, T. A. WILLIAMS (*U. S. Dept. Agr., Division of Agrostology Circ. 12, pp. 6, fig. 1*).—This circular contains brief popular notes on the culture requirements and feeding value of rape. The plant is described, the most important varieties re mentioned, and the different ways of utilizing the crop are suggested.

Sugar-beet investigations in 1898, C. W. MCCURDY and T. SMITH (*Idaho Sta. Bul. 18, pp. 31-52*).—This bulletin contains a report on culture experiments carried on at the station and in various sections of the State. Directions for the culture of sugar beets, the destruction of insect pests, and instructions for taking samples for analysis are given. Results of 472 analyses show an average sugar content in the beet of 15.53 per cent and an average purity of 82.76. The cost of producing an acre of beets at the station was $32. The profits in beet and wheat raising are compared.

Experiments in the growth of sugar-beet roots in Great Britain (*Jour. Bd. Agr. [London], 6 (1899), No. 1, pp. 45-55*).—A circular of inquiry was addressed to 400 experimenters with sugar beets as to results obtained in 1898. Replies were received from 143 different growers as to methods of planting, soil, yield, sugar content of beet, etc. The data are tabulated for 47 of the most reliable tests. The average quantity of sugar in 100 parts of juice was 15.65 per cent; average purity quotient, 85.19 per cent; average per cent of sugar in 100 parts root, 14.48. The average yield without tops was 16.3 tons per acre.

Fermentation of tobacco, G. DE WAMPE (*Jour. Agr. et Hort., 3 (1899), No. 6, pp. 138–140*).

Cultivation of tobacco on the Sochinsk Agricultural Experiment Station, V. SHCHERBARCHEV (*St. Petersburg, 1898, pp. 10; rev. in Selsk. Khoz. i Lyesov., 192 (1899), Feb., p. 475*).

The velvet bean, J. G. SMITH (*U. S. Dept. Agr., Division of Agrostology Circ. 14, pp. 5, figs. 3*).—Brief popular notes are given on the origin, culture, yield, value, and uses of the velvet bean (*Mucuna utilis*).

Wheat culture in the future, O. MOSZEIK (*Fühling's Landw. Ztg., 48 (1899), No. 15, pp. 595–598*).—An article discussing the world's wheat supply and the condition of wheat culture in various countries.

The production and cultivation of wheat in Portugal, L. DE CASTRO (*La production et la culture du blé au Portugal. Lisbon, 1893 (Portuguese), pp. 67*).

Yield of wheat at the Cappelle Experiment Station for the harvest of 1899, F. DESPREZ (*Jour. Agr. Prat., 1899, II, No. 36, pp. 341–343*).—Notes on 37 varieties tested experimentally and data for the yields of grain and straw of 7 varieties tested on a larger scale for the years 1896–1899. Yellow-Bearded Desprez has given the best results for each of the four seasons, the average yield being 4,705 kg. of grain and 11,302 kg. of straw per hectare.

HORTICULTURE.

Horticultural experiments at Southern Pines, 1896 (*North Carolina Sta. Bul. 159, pp. 97–171, figs. 30*).—This is the second annual report of the operations of the North Carolina State Horticultural Society Experimental Farm at Southern Pines. The organization of the board of control, preliminary work of getting the experimental plats in suitable condition, and general plans of the experiment have been previously described (E. S. R., 8, p. 693) and are only briefly noted here.

The object of these investigations is to determine, by a series of experiments extending over a period of years, the best quantities and relative proportions in which to use the various fertilizing substances for the best growth of fruit and vegetables at the least cost. Incidentally, the best insecticides and fungicides for use on the different crops will be studied. No commercial brands of fertilizers are used, but fertilizing ingredients are employed in different combinations, and green manuring practiced in some instances.

The experiments are conducted on tenth-acre plats for orchard fruits and nuts, fortieth-acre plats for small fruits, and twentieth-acre plats for vegetables. The kinds, combinations, and amounts of fertilizers applied to each plat, and the chemical analyses of each are shown in tabular form. The growth and yields of different crops are illustrated by photographs.

Vegetables were included in the list of crops experimented with in 1896; Station Hybrid sweet corn, White Southern Queen potato, Early Wakefield cabbage, Palmetto asparagus, Livingstone Beauty tomato, Valentine snap bean, White Spine cucumbers, and White Bliss Irish potatoes being employed.

The results of the season's work with fruits are summarized and tables given which show the vigor of growth and air-dried weight of prunings of peaches, plums, apples, and grapes; the height in inches of peach, plum, and apple trees, and the analyses (fertilizer constituents) of grape prunings and strawberry runners on each of the plats differently fertilized. These data are compared with the results obtained in control plats. In the estimation of the writers the data thus far obtained places the agricultural value of different forms of potash for young fruits in the following decreasing order: Sulphate, muriate, double manure salt, carbonate of potash-magnesia, and kainit. Little or no benefit has as yet been shown by the use of green manure. This is thought to be due to the heavy draft on the soil moisture made by the growing legumes.

The data for work with vegetables are given in detail, but no conclusions are drawn. These data show the yield and chemical analysis (fertilizer constituents) of the vegetables grown with different fertilizers, and in addition the starch, sucrose, and glucose of the sweet potatoes.

Ants were again the most serious insect pests in 1896. They were combated entirely by tillage. Some 14 other species of insects were more or less prevalent during the year, and a few of the more usual fungus diseases made their appearance. Bordeaux mixture, with the addition of Paris green and molasses, has formed the main combative measure against these injurious agents.

Plant growing with commercial fertilizers, W. STUART (*Trans. Indiana Hort. Soc., 1898, pp. 105–113, dgm. 1*).—This paper briefly describes the Indiana Station vegetation house and its equipment, and presents the results of 3 series of experiments with fertilizers on lettuce.

The first of these experiments has already been reported (E. S. R., 9, p. 1048). The general plan of the second experiment was similar to that of the first. The bed there described was used in the second test but was divided into 7 instead of 6 sections. Two sections were used as checks. Of the remaining sections, one received dissolved boneblack, one dissolved boneblack and muriate of potash, one dissolved boneblack and sulphate of potash, one dissolved boneblack and nitrate of soda, and one dissolved boneblack, nitrate of soda, and muriate of potash, at the following rates per acre: Dissolved boneblack 1,450 lbs., muriate of potash 658 lbs., sulphate of potash 564 lbs., and nitrate of soda 732 lbs. Grand Rapids lettuce was grown as in the previous experiment. The average weight of the individual plants grown with the different fertilizers was as follows: Control sections, 87.4 gm.; dissolved boneblack alone, 120.8 gm.; dissolved boneblack and muriate of potash, 133.7 gm.; dissolved boneblack and sulphate of potash, 123.4 gm.; dissolved boneblack and nitrate of soda, 134.6 gm.; and dissolved boneblack, nitrate of soda, and muriate of potash, 139.2 gm.

The third experiment was conducted in the station vegetation house in zinc pots, to further test the 2 forms of potash, and phosphoric acid from other sources. "Twenty-one pots, about 10 in. in diameter and of the same depth, were used in this trial, 3 pots being used for each combination." Raw bone meal alone and in combination with sulphate and muriate of potash and with nitrate of soda was used in 5 series, acidulated bone and nitrate of soda in one series, and one series was used as a check. Two plants were grown in each pot and each series was harvested when at its best. The average weight of the individual plants in each series, and percentage increase in weight of plants in the fertilized series over the checks, are tabulated. The data shows a gain in weight of plants over the checks of from 132.1 per cent with raw bone meal alone, to 232.9 per cent with raw bone meal, muriate of potash, and nitrate of soda mixed. The complete fertilizer gave increased yields over combination by twos of 74.7 per cent. But little difference was noticeable in the effect of raw and acidulated bone. Muriate of potash gave slightly better results than the sulphate.

The yields of the 3 sets of experiments are tabulated side by side and compared graphically. The author believes the experiments show that "the addition of phosphoric acid in some form is highly essential to successful lettuce culture;" and that "the addition of potash and nitrogen to phosphoric acid produces a considerable increase over that of phosphoric acid alone."

Notes on the winterkilling of twigs and buds, F. A. WAUGH (*Vermont Sta. Rpt. 1898, pp. 302–306*).—This article is an abstract of a thesis by L. W. English. A study was made of the minute structure of twigs of various trees and shrubs to determine whether hardiness depends on any anatomical peculiarities, but with negative results. Observations were made confirmatory of the theory that "twigs best stored with reserve materials will be best prepared to stand freezing weather." Observations were also made upon the losses by evaporation from apple twigs in winter, which were in practical agreement with others already reported (E. S. R., 8, p. 311; 10, p. 152). It was also found that buds of apple, cherry, and plum trees in Burlington, Vermont, lost from 2.9 to 7.9 per cent of their total weight by evaporation between December 20, 1897, and January 29, 1898. It is believed that "the drying out of fruit buds, if excessive, would be even more disastrous than the desiccation of twigs."

Twigs of various trees were covered with whitewash, others blackened with lampblack, still others coated with wax, and some left as a check. These were started together in the greenhouse. The blackened twigs were earliest in opening and the whitewashed twigs latest. The waxed twigs started slowly and irregularly and were evidently injuriously affected.

Variation in the graft and transmission of acquired characters, L. DANIEL (*Ann. Sci. Nat. Bot., 8. ser., 8 (1898), Nos. 1–6, pp. 226, figs. 19, pls. 10*).—In this article the author demonstrates the existence of a reciprocal action of stock and scion, inducing a direct or indirect variation of the grafted plants.

Variations in the graft may be due to changes in nutrition or may be specific; that is, they may appear in the particular characters of the stock and scion more or less independently of environment. The latter has been, however, a much debated question and the arguments of previous writers for and against it are briefly reviewed.

The article is in two parts. The first part is devoted to a study of the variations produced by grafting directly on the associated plants. A large number of experiments are reported and discussed, developing the facts of variation, after which the attempt is made to give a theoretical explanation of them. The effect of grafting on the general nutrition may be shown in four ways:

(1) The size of the vegetative organs of stock and scion may be modified. If an herbaceous plant is grafted on itself, the general nutrition is interrupted in inverse proportion to the activity of the cambium layer at the time the operation is performed. The same principle applies in the case of grafts between different plants of the same variety. In the case of grafts between plants of different varieties, species, or genera, the reciprocal reactions are much complicated by imperfect functional adaptations. In herbaceous grafts the callus has the same effect on the scion as would placing it in arid soil—it is dwarfed. In determining what species of the same order may be successfully grafted, similarity of habitat is of more importance than relationship. In the case of ligneous plants, the author shows that geotropism is a cause of variation, although this has generally been denied heretofore. It is also shown that a branch that has lost its negative geotropism does not always regain it if grafted on the main axis of the stock, at least in the case of the pear.

(2) The flavor of edible parts, their size, chemical composition, or season of development, may be modified. If the union is perfect, grafting in general produces a change of flavor in the edible parts of vegetative organs. This change may be either in the nature of an improvement or deterioration in quality. There is almost always a reduction in the size of the part which sometimes fails entirely to develop in edible form. For the operation to have practical interest, the diminution in size must be compensated by increase in quality. When the edible parts belong to the reproductive organs, grafting herbaceous plants may or may not cause the enlargement of the pericarp of fleshy fruits or of the seeds in dry fruits. There is no known principle of general application. The flavor of the fruit depends principally on the completeness of the union and the quantity of sap that the scion receives. This principle applies to ligneous and herbaceous plants alike.

(3) The development of the reproductive organs of the scion may be accelerated or retarded. The flowering season of the scion may be affected very differently, according as the plant is annual, biennial, or perennial; according to the time the graft is made; according to the age and nature of the scion, and according to the kind of graft

employed. Grafting may induce variation in the arrangement of flowers, in the season of opening or falling of the petals, or in their color.

(4) The relative resistance of stock and scion to parasites and other injurious organisms or substances may be modified. The principal parasites that attack grafts before the union is complete are mollusks, worms, saw bugs, insects, and molds. These parasites may affect the stock and scion differently. The parasites that attack grafted plants after the union is complete are, in the order of the extent of their ravages, insects, myriapods, fungi and other vegetable parasites, and mollusks. The more imperfect the union of stock and scion the more serious are the attacks; so much so that their extent and severity may be said to be a criterion of the degree of perfection of the symbiosis.

The theory by which the author undertakes to explain these facts is developed at much length. In brief, the nutrition of stock and scion is modified by two causes which may act in the same or contrary directions. These are (1) the callus consequent on the operation, and (2) the difference between the peculiar functional capacities of stock and scion, such as differences in structure, special diastases, differences in composition of the crude or elaborated saps, etc. The phenomena produced are dependent not only on the nature of the plant, but intimately so on environment.

From this theory certain conditions of success in grafting may be deduced. The protoplasm of stock and scion must not, as a result of the operation, be modified beyond that definite point at which poisoning sets in or at which the essential properties of the living substance, as nutrition and motility, are destroyed. Destruction of the protoplasm may result from either of two causes: (1) From the action of plastic or waste products which are brought together suddenly, causing immediate poisoning or gradually causing slow poisoning. These products may give rise through mutual reactions to other injurious products. (2) From deficiency or excess of water in stock or scion, consequent upon grafting.

The author demonstrates the insufficiency of the hypothesis of relationship and that of similarity in composition of elaborated saps to account for the success of a graft or to explain its variations.

A large number of experiments are reported, each illustrating a different variation, all referred by the author to the category of variations produced directly by a mutual reaction of stock and scion. Specific variations differ much in degree, according to the nature of the plant and even according to the part of the scion. This principle applies alike to herbaceous and woody plants. Specific variations result in a more or less complete blending of the characters of stock and scion, or more strictly, these characters appear side by side but separate and distinct. The explanation of the effects of variation in the graft by the hypotheses of xenia and of mutual reaction of the protoplasm are discussed at length. The author believes that the latter hypothesis is sufficient to explain all cases that have arisen, and shows that the former is not.

A method has been devised for the partial differentiation of variations due to nutrition and specific variations by the mixed graft (E. S. R., 9, p. 945). Experiments are reported showing that specific variations may be augmented by mixed grafting to the extent that asexual hybridization is induced.

The second part of the article discusses the inheritance of characters acquired through grafting. Variations due to nutrition were in some cases transmitted by seed collected from the scion, even when no morphological changes were apparent in the scion itself. Such a case shows that the immediate influence of the stock on the scion may be less than its indirect influence on the offspring of the scion. Seed grafts of wild carrot on the cultivated half long red variety showed clearly such a mixture of the characters of stock and scion that the resulting plants might be considered true crosses or graft hybrids produced by the influence of the stock on the embryo. These and similar experiments show also that by grafting a wild on a cultivated plant the former may be made to acquire definite qualities which can be improved by selection. Experiments showed also that these variations which the author classes as specific are at least in certain cases transmitted by the seed. A preliminary report is made of experiments on the inheritance of characters acquired as a result of mixed grafting. No general conclusions are drawn.

In conclusion, the graft may have an influence on the somatoplasm, though this is not always the case. In many plants the effect is often very slight, especially in woody plants, in which the ligneous framework gives to the plant a much more fixed form than herbaceous plants possess. When this influence exists it most often affects characters of little taxonomic importance, as height, vigor, etc., and then its influence is similar to that of environment; but it may sometimes affect the essential characters of varieties or species, such as external form, structure, etc., which become more or less blended into graft hybrids or may disappear, giving place to entirely new characters. Not only may the influence of the graft on the somatoplasm show itself directly in the grafted plants themselves, but it may produce an indirect reaction either parallel or not parallel to the direct reaction, and new characters may develop in the offspring, demonstrating that in the vegetable kingdom acquired characters can, contrary to the theory of Weismann, be transmitted.

From these theoretical considerations certain practical conclusions may be deduced. When grafting does not modify the peculiar characters of a variety, but merely produces certain slight variations of nutrition, it may be employed to perpetuate varieties, races, or accidental forms of perennial plants; but if the influence of the graft on the somatoplasm is very marked and proves to be specific, which experiment alone can determine, it may be applied to the creation of new varieties. Thus a new field of operations is opened up to seedsmen.

Hardiness of plums, F. A. WAUGH (*Vermont Sta. Rpt. 1898, pp. 273–279, dgms. 3*).—The approximate northern limit of successful culture of each group of plums is investigated and discussed. The limits of Lombard and Bradshaw (Domesticas), Burbank and Kelsey (Japanese), and the Wildgoose group are graphically represented. The Americana and Nigra groups are said to be the hardiest of all plums, thriving about as far north as any permanent form of agriculture is found. The Wayland group is believed to be about as hardy as the Wildgoose, and the Miner group slightly hardier. The northern limit of the Chicasaws has not yet been satisfactorily determined.

Problems in plum pollination, F. A. WAUGH (*Vermont Sta. Rpt. 1898, pp. 238–262, figs. 1*).—This is a continuation of work already reported (E. S. R., 9, p. 837). Experiments to determine the self-sterility of plums were continued. The results further substantiated the conclusions reached in 1897. "In all the tests which we have made in 3 years in Maryland and Vermont, practically all varieties of [native and Japanese] plums have proved to be absolutely self-sterile. The only positive exception to this rule is the Chicasaw variety Robinson."

Reliability of experimental method (pp. 240–244).—Certain objections are discussed that have been made to the reliability of the method of testing self sterility by covering blossoms with paper sacks, as used by the author in common with other experimenters. "(1) It is said that blossoms covered with paper sacks are not pollinated, or, at most, the experimenter has no assurance that they are. (2) The paper cover introduces an unnatural condition, which may interfere with the development of the young fruits, even after pollination is properly effected." To these objections the following considerations are opposed:

"(1) As to uncertainty of pollination. (a) In the experiments of 1897 . . . 6,365 [covered] blossoms set only 3 fruits. . . . It seems incomprehensible that [such a small proportion of blossoms] should have been able to pollinate themselves. (b) The circumstances are not unfavorable to pollination. . . . [Covered clusters of blossoms] furnished an abundance of pollen within the sack, so much that, in many instances, when a sack was removed, a considerable quantity of the yellow dust could be shaken out into the hand. The agitation of the sacks full of blossoms in the wind seemed to insure an effectual distribution of the pollen to all or nearly all the stigmas. (c) Further than this, sacks were removed in many cases and the stigmas examined with a lens. In all such instances, quite without exception, the stigmas were found to be liberally covered with pollen. . . . (d) In a number of cases the sacks were removed when the blossoms were opened and the stigmas receptive, and pollination was carefully accomplished by hand. In these cases the results were not different. (e) The variety Robinson, in several different experiments in Vermont and in Maryland, has always set more or less fruit. This has seemed to prove its self fertility in those cases and at the same time to show that a sufficient pollination is usually secured under the experimental conditions in question.

"(2) As to the introduction of unnatural conditions. (a) The fact just brought out under (e) . . . seems to show that the conditions are not sufficiently unnatural

> to account for the results secured in our experiments. (b) The principal answer to this objection, however, lies in the fact that blossoms cross-pollinated by hand and inclosed in paper sacks, other conditions being reasonably favorable, almost always make a satisfactory setting of fruit."

Opinions confirmatory of the above are quoted from private correspondence with experts (E. S. R., 6, pp. 46, 47). Studies of pollination affinities have led to the conclusion that all the commonly cultivated Japanese and native varieties belonging to several different species seem to be quite reliably interfertile.

The theory advanced by Heideman[1] that the pollination affinities of plums are to be judged from structural variations of the blossoms was investigated but failed of verification.

Investigations were made on the relation of insects to pollination of orchard plums. Large clusters of plum blossoms of several varieties were covered with coarse mosquito netting, thus excluding the ordinary insect visitors, but permitting free pollination by the wind. Not a fruit was set under the netting, although a crop was obtained from the rest of the tree. An enumeration of 28 species of insects captured on plum blossoms is made. Of these, 18 were Hymenoptera and 10 Diptera. Most of these species take little active part in pollination. The common honeybee is believed to be chiefly instrumental in the distribution of pollen.

Blossoming season of plums (pp. 248-257).—From a study of the duration of the blossoming period of plums in 1898, the following conclusions are drawn:

> "Under circumstances of good weather the blossoms of a given variety are open and the stigmas receptive in sufficient number to insure the setting of a full crop of plums for from 1 to 3 days.
>
> "When the weather is bad, a given variety may remain in blossom for an indefinitely long time, though usually there will not be a sufficient number of pistils in condition to set a crop through more than 5 to 7 days.
>
> "When no pollen is available, or when by any means fecundation is prevented, stigmas will remain receptive 4 to 6 days, even in sunny weather."

But regarding these statements it is remarked that the real pollination is often effected within 3 to 4 hours of a single day in bright, sunny weather, and that though a tree may remain in bloom for 2 or even 3 weeks during cold, rainy weather, it is almost certain not to set any fruit in such a case.

From a comparison of the blossoming seasons of several varieties of plums the conclusion is drawn that probably the variations from year to year in the order of blossoming are of small practical consequence in any given locality.

A further comparison of varieties in widely different localities was made to determine whether the blossoming periods of both follow the same order. In 22 out of 25 varieties selected at random the deviations were "not more than 2 days in either direction—a difference which might easily be caused by local influences of soil or transient influences of climate." The blossoming chart published last year has been reconstructed and improved. It is believed that such a chart is most trustworthy for the locality where the notes are taken, but that, granting room for some exceptions, it may be used in other localities without fear of serious mistakes. In order to assist in its interpretation for other localities and at the same time to give a fuller idea of the progress of the annual flowering season, 2 isophenal charts are arranged to present a view of the blossoming seasons of 2 standard varieties for 1898.

---

[1] C. W. H. Heideman, The Sexual Affinities of *Prunus americana*, Minn. Hort. Soc. Rpt. 23 (1895), p. 187.

The grape, J. C. WHITTEN (*Missouri Sta. Bul. 46, pp. 31-76*).—Studies were made on about 150 varieties with reference to their comparative value for commercial purposes and home use, adaptability of the different types to Missouri, self-fertility, blossoming period, and average size of bunch and berry. Data are tabulated showing the origin of each variety if known, its vigor, health, productiveness, weight of average fruit cluster, weight of average berry, color of fruit, flavor, date of first flowering, full bloom, last flower, ripening, and period of fruiting, with notes on self-fertility. The varieties are also arranged in the order of their ripening in 1898, according to average weight of berry and average weight of bunch, the weights being given for each variety.

> "The following varieties ripened in 1898 ahead of Moore Early: Early Ohio, Champion, Green Mountain, Moyer, Hartford, Jewel, Ives, Janesville, New Haven, Aminia, and Brighton.
>
> "Among the best very early varieties for commercial planting, judging from our own experience and the experience of practical growers, are: Green Mountain, Campbell Early, Jewel, New Haven, Aminia, Brighton, Moore Early, and Norfolk.
>
> "The grapes having the largest berry are: Columbian Imperial, McPike, Eaton, Salem, and Moore Early.
>
> "The Ozark is the most vigorous and productive variety we have tested.
>
> "Among the most promising comparatively new or little-known varieties are America, Aminia, Brilliant, Campbell Early, Green Mountain, Hicks, McPike, New Haven, Norfolk, Ozark, Rochester, and Rommel."

The sacking of most varieties of grapes was found profitable. Green Mountain gave better results under the treatment than any other variety tested. About 40 per cent of the varieties in the station vineyard were found to be self-sterile. Experiments indicated that the source of the pollen had no effect on the character of the fruit, but were inconclusive.

Notes are given on a considerable number of varieties and on the species in cultivation. Æstivalis and Lincecumii are considered best adapted to Missouri. Labrusca produces the largest and finest fruit, but sometimes suffers from the heat of summer.

Cold storage for fruit, E. E. FAVILLE and W. L. HALL (*Kansas Sta. Bul. 84, pp. 31, pls. 2, dgms. 3*).—This bulletin treats of cold storage for fruit on the farm and in cities. Cold storage on the farm may be with or without ice. In one case of home storage without ice, a storehouse was made by lining the bottom and sides of an old hotbed with straw and covering with the same material and oiled muslin. This method is not considered safe in Kansas in a cold winter. Another case is that of a cave in a hillside sloping to the north. Details of construction are given. In order to secure the best system of ventilation and the most even and desirable temperature, the use of an underground pipe for ventilation is recommended, leading from an opening in the floor of the cave to a similar opening on the surface of the ground several rods away. Plans and specifications are given for a cold storage house in which refrigeration is provided for by packing ice in the second story.

The advantages of cold storage at home and in cities are enumerated.

A table partly compiled and partly based on experiments at the station shows the best temperature for preserving summer and winter apples, pears, peaches, grapes, plums, berries and cherries, bananas, lemons, oranges, figs, raisins, watermelons, muskmelons, tomatoes, cucumbers, celery, cranberries, onions, potatoes, asparagus, and cabbage, and indicates the packages in which they should be stored and the time they may be expected to keep.

A series of experiments in the preservation of fruits in cold storage were carried out in cooperation with two cold storage companies in different cities. Trial shipments were made of peaches, grapes, plums, tomatoes, cucumbers, pears, and apples. Egg cases gave superior results as shipping packages for peaches. Grapes packed in sawdust kept better than those stored by any other method. Cut cork is suggested as an even better packing material for grapes. It is believed that the best results in storing grapes can be obtained in a room cooled by dry, cold air currents. Red varieties of grapes kept longest, followed in order by white and black sorts. The early varieties kept best, but no extremely late varieties were tried. For best results in cold storage, a grape should mature slowly in a climate of moderately cool, regular temperature. Tomatoes should be picked when just beginning to ripen. Cucumbers were not a success.

Experiments with pears were on a very small scale. Winter Nelis grown in Kansas did not keep so long as the same variety from California. Varieties with open cores kept best. A quoted opinion advises wrapping each individual peach, pear, and plum. Tests with apples indicated that considerable difference exists in varieties as to the length of time they will keep and the temperature at which they will keep best. Apple scald is briefly described. Notes are given on the production of fruit intended especially for cold storage. The practical points in the handling of fruit for cold storage are gone into throughout the bulletin in great detail.

Cold storage of fruit (*Jour. Bd. Agr.* [*London*], *6* (*1899*), *No. 1, pp. 85–87*).—This is an abstract of a report of experiments in England on cold storage of fruit.

"[Each of 3 chambers] was fitted with tiers of galvanized wire shelves around the sides, and the fruit was placed on these under three different conditions: (1) Exposed on the shelves, (2) enveloped in grease-proof paper, and (3) surrounded or covered by cotton wool. It was found that strawberries could be kept for at least 3 weeks in a temperature of 30°, but it was necessary to surround the fruit with cotton wool, or, in the case of fruit in sieves, to place a pad of that material over the top. When this precaution was not taken, the fruit, though sound, became dull and lost the fresh, inviting appearance which is so important when it is offered for sale. Black currants kept well for 10 days, after which they began to shrivel, but plumped and freshened on exposure to the air so as to be marketable. This was especially the case with black currants that had been stored in market sieves covered with a wad of cotton wool. After a fortnight's storage, the temperature was raised from 30 to 32° F., and this seemed to give the best results. The experiments with red currants were an unqualified success, the fruit remaining perfectly sound for 6 weeks, and maintaining its freshness when exposed to a normal temperature for 16 hours. Cherries covered with wool kept for a month at a temperature of 30°, and at 36° were not only sound, sweet, and juicy, but fresh and clear. After the fourth week the fruit began to wrinkle. . . . Green Gages were kept in excellent condition for 10 weeks and Victoria plums kept for 9 weeks, but the cooking varieties of plums, with that exception, did not lend themselves satisfactorily to cold storage. In the case of apples, specimens of most of the leading dessert sorts were stored on September 17 and October 8, and, with one or two exceptions, they kept until the end of January, a temperature of 36° being found most suitable."

Pears kept at the same temperature, or a trifle under, for 3 or 4 months; individual apples and pears of a number of varieties, most of which did not ordinarily keep later than Christmas, kept in storage until the end of March. Tomatoes were kept for 6 weeks, but the fruit was injured by a discoloration at the point of attachment of the stem.

Belgian horticulture (*Florists' Exchange, 11 (1899), No. 10, pp. 1003, 1004*).—Extract of a paper on this subject read by S. S. Bain before the Canadian Horticultural Association.

Construction and management of hotbeds, F. A. HUNTLEY (*Idaho Sta. Bul. 17, pp. 17–28, figs. 4*).—Popular notes on the construction and management of hotbeds, especially for the home garden. It is recommended that a hotbed for the use of a family of ordinary size contain at least 45 sq. ft. of ground surface. Corner blocks are preferred to posts, and a width of 5 ft. for the hotbed is considered more convenient than 6 ft.

Culture of asparagus and the use of commercial fertilizers, E. C. PRADEL (*Jour. Agr. Prat., 1899, II, No. 35, pp. 299–302*).—Analyses are given of the asparagus soils of the Meurthe-et-Moselle district and of asparagus (fertilizer constituents of edible asparagus and of complete stems). With this data as a basis the author endeavors to show that the addition of some form of commercial fertilizer to such soils supplementary to barnyard manure is a necessity. A formula for this purpose is given, with suggestions as to the time and manner of application.

Asparagus—raising, growing, and forcing, G. HATFIELD (*Garden, 56 (1899), No. 1449, pp. 156–158, fig. 1*).—Paper read before the Royal Horticultural Society at its meeting April 18 and based largely on the results of the author's own experience.

Variation in the graft and the transmission of acquired characters, L. DANIEL (*La variation dans la greffe et l'hérédite des caractères acquis. Paris: Masson, 1899, pp. 220, pls. 10*).—See p. 343.

Peach culture, J. H. HALL (*Trans. Massachusetts Hort. Soc., 1899, pt. 1, pp. 32–38*).—Paper, with discussion, read by the author before the society at its January meeting. It deals largely with New England conditions.

Monograph of the Wayland group of plums, F. A. WAUGH (*Vermont Sta. Rpt. 1898, pp. 280–287, figs. 6, pls. 5*).—The group is stated to be one of the most distinct of the indigenous American plums. The several varieties are more uniform than in most groups. They are especially adapted to the Central and Southern States and probably would be found hardy much farther north. Varieties of this group are characterized by clear white buds and generally by great firmness of flesh. They are especially desirable for shipping long distances, preserving, and spicing.

Plums under glass (*Jour. Hort., 51 (1899), Nos. 2657, pp. 199, 200; 2659, p. 238*).—Popular directions for the growing and management of plums under glass.

Hybrid plums (*California Fruit Grower, 24 (1899), No. 591, p. 5*).—Discussion of this subject based largely on the work of F. A. Waugh.

The forcing of pineapples (*Wiener Illus. Gart. Ztg., 8 (1899), No. 9, pp. 296–299*).—Directions, based on experience, for the successful forcing of pineapples.

Cocoa planting in Samoa (*Planting Opinion, 4 (1899), No. 33, pp. 662, 663*).—The details of cocoa growing and the development of this industry since its introduction in Samoa in 1892 are briefly discussed.

Cacao, G. S. GENMAN and J. B. HARRISON (*Rpt. Agr. Work Bot. Gard. [British Guiana], 1893–1895, pp. 105–121*).

The mango (*Bul. Roy. Bot. Gard. Trinidad, 3 (1899), No. 20, pp. 190–219, figs. 12*).—Illustrated descriptions of 12 varieties of mangoes (*Mangifera indica*), with an account of the growth of mangoes in the Royal Botanic Gardens of Trinidad and a discussion of shipping requirements

The strawberry manual, LAXTON BROS. (*Bedford, England: Laxton Bros., 1899, pp. 139*).—This book comprises information dealing with the origin and history, hybridization, crossing and seedling raising, and cultivation in private gardens and for market. Chapters are also given on forcing, manures, insect and fungus enemies, and suitable varieties for different purposes and various soils.

Report on strawberries for the season of 1899 from the Strawberry Valley Fruit Farm, Maine, E. W. WOOSTER (*Amer. Gard., 20 (1899), No. 249, p. 670*).—This is a brief report on the results obtained in a test of nearly 100 varieties of strawberries. "The most profitable varieties were Parker Early, . . . 15,000 quarts per acre; . . . Glen Mary, Clyde, Haverland, Ridgeway, and Lovett on beds fruiting the first season, and the Bubach and Beverly on beds fruiting the second season." The Clyde was injuriously affected by the wet weather. Glen Mary held its size the best of all the varieties tested. The Hunn was the latest to blossom.

Late strawberries, J. S. W. (*Garden, 56 (1899), No. 1451, p. 198*).—Notes on desirable late varieties, with cultural directions and special consideration of alpine strawberries.

Experiences in rational coffee culture, F. W. DAFERT (*Erfahrungen über rationellen Kaffeebau. Berlin: Paul Parey, 1899, pp. 60, pls. 2, figs. 24*).—Part I of this work deals with the limits of productivity of a coffee plantation, Part II with the factors which influence its productivity, and Part III with the means by which its productiveness may be increased. The work is based on the results of the author's experimental work on coffee culture in Brazil and on the work of Lester Arnold, Rigaud, van Gorkom, Morren, and other investigators in India, Madagascar, Java, and other coffee-producing countries. The chapter dealing with the fertilization of coffee trees is especially instructive.

The hollyhock, R. P. BROTHERSTON (*Jour. Hort, 51 (1899), No. 2658, pp. 205, 206*).—Directions are given for the culture of hollyhocks with regard to the avoidance of the hollyhock disease. The author advises that seed be sown the end of August or first of September and the plants potted about the last of January. They should then be kept in a dry, cold pit for the remainder of the winter and planted out in the spring. Commercial fertilizers have been used with success by the author as a substitute for barnyard manure in the culture of hollyhocks.

Notes on lilies, F. A. WAUGH (*Vermont Sta. Rpt. 1898, pp. 296–302*).—An enumeration of the known species of the genus Lilium, following the order of Baker's Analytical Key as given in Nicholson's Dictionary of Gardening. Eight species new to Baker's list are added, including 1 species that Baker classed as a variety. Brief horticultural notes are given on nearly all species.

Miltonia bleui, H. DAUTHENAY (*Rev. Hort., 71 (1899), No. 17, pp. 400–402, figs. 2*).—A description of this comparatively new orchid obtained by M. Bleu by crossing ***Miltonia vexillaria*** on ***M. rœzlii***.

The new giant violets, J. C. HOUSE (*Garden, 56 (1899), No. 1454, pp. 260, 261, col. pl. 1*).—Six varieties of these violets are described and notes given on their culture in the open and under glass.

Lawn management and seed mixtures, F. P. SPERRY (*Proc. Columbus Hort. Soc., 13 (1898), pp. 28-31*).—Notes on the preparation and care of lawns.

A new drought-resistant sod—Carex alba, P. DE LA BATHIE (*Rev. Hort., 71 (1899), No. 17, p. 403*).—The author has employed this sedge in his garden as a border for flower beds and for lawn purposes with excellent results for 5 years. It has been especially valuable during dry seasons. Cultural directions are given. The plant is thought very desirable for light soils.

Caraganas, W. J. BEAN (*Garden, 56 (1899), No. 1450, pp. 177, 178, fig. 1*).—Detailed descriptions of 12 varieties and species of this hardy shrub, with a discussion of their ornamental features, and recommendations as to the most desirable varieties to grow.

Hedges, their planting and care, P. JURASS (*Deut. Landw. Presse, 24 (1899), No. 70, p. 797*).—Hawthorn hedges are especially considered and suggestions given regarding a large number of other shrubs suitable for hedge growths.

SEEDS—WEEDS.

Impurities of Vermont clover seed, L. R. JONES and W. A. ORTON (*Vermont Sta. Rpt. 1898, pp. 229-234, fig. 1*).—In the spring of 1897, 34 samples of clover seed were obtained from farmers in various portions of the State. These were carefully examined for impurities, which are divided into inert matter and viable seeds, including all foreign seeds that were apparently sound. Twelve samples of alsike and 20 of red clover were examined, the results being shown in tabular form. The percentage of viable weed seeds in red clover varied from 0.3 to 3.2, with an average of 1 per cent. In the alsike the weed seed varied from 0.4 to 5.2 per cent, with an average of 2.5 per cent. In a number of the samples several weed seeds considered most pernicious were found to be quite abundant. Most noteworthy of these were the sheep sorrel, English plantain, bracted plantain, wild carrot, and dodder. Sorrel was found present in 60 per cent of the red clover samples examined, and the English plantain occurred in 70 per cent of them. It seems from a statement made in the report that the larger seed dealers have facilities for cleaning the seed, and the purity of the sample depends largely upon the demand for high or low priced seed.

Influence of size of seed on germination, A. J. J. VANDEVELDE (*Bot. Jaarb. Dodonæa, 10 (1898), pp. 109-131, pls. 6, figs. 2*).—The author reports upon germination studies of 1,800 each of large, average, and small seeds of peas, oats, rye, wheat, and barley. Each lot of seed was divided into lots of 100 and germinated under identical conditions.

Among the results given it is stated that the time required for the germination of large seeds is greater than for small ones, but the difference is slight, being unappreciable in the case of peas and rye, and even less with wheat and barley.

The total germinations were greater for the small seed in every case except with barley. For peas, rye, and wheat the difference is considerable, and for oats it is slight. In the case of barley the large seed possessed the greatest germinative energy.

The author believes that in agricultural practice, depth of seeding, variation in composition of the soil, insect injuries, etc., exert a much greater influence than size of seed. These conclusions apply only to the germination of the seed, without any reference to vigor or fertility of the plant.

On the artificial use of enzyms in germination, F. A. WAUGH (*Vermont Sta. Rpt. 1898, pp. 290–295*).—In continuation of investigations previously reported (E. S. R., 9, p. 844), the author has studied the effect of a number of diastases on germination of old seed. In previously reported experiments a number of different kinds of seeds were used, while in those presented in this report the experiments were confined to tomato seeds. The experiments are said to confirm the tentative generalizations of the previous year, and it is claimed that the various enzyms used act upon the seeds by the conversion of a proportionately large quantity of the starch contained, and it can hardly be questioned that this conversion is to the advantage of the seeds in germination. The tomato seeds which react especially well toward various enzym preparations contain an unusual amount of fat. What the connection between these two facts may be is not yet clear.

Weeds of Oklahoma, E. E. BOGUE (*Oklahoma Sta. Bul. 41, pp. 12, figs. 14*).—The present bulletin, which is designed in some respects to replace Bulletin 17 of the station (E. S. R., 7, p. 872), describes as far as possible those weeds that are most abundant throughout the Territory and which interfere with agriculture in all its branches. Some of the worst weeds of the Territory are omitted, as they are only so far known in restricted localities. Suggestions are given, under the discussion of each species, for their destruction.

Among the weeds listed are the following: Perennial ragweed, Buffalo bur, crab grass, bull nettle, Torrey night-shade (*Solanum torreyi*), horse nettle, prairie acacia, pigweed, bindweed, fleabane, horseweed, sunflower, croton, snow-on-the-mountain, tumbleweed, passion vine, and purslane.

Notes upon Vermont weeds, L. R. JONES and W. A. ORTON (*Vermont Sta. Rpt. 1898, pp. 219–228, figs. 7*).—In response to a circular of inquiry sent out by the botanist of the station, a number of replies relative to the more troublesome weeds of the State were received. These were grouped into several categories based upon the frequency with which they were reported. Those most frequently reported are: White daisy, kale (*Brassica* sp.), orange hawkweed, wild carrot, witch grass, golden-rod, yellow daisy, plantains, ragweed, sorrel, docks, and hardhack. Other lists are given in which 10 less serious offenders are mentioned, and a list of some 60 others occasionally mentioned completes the report.

Report of the seed-control station at Gothenburg (Sweden) for 1897–98, J. E. ALÉN (*Gothenburg, 1898, pp. 15*).

Effect of electricity on seed germination, G. TOLOMEI (*Rend. Acad. Lincei, Rome, 7. ser., 5 (1898), No. 1, pp. 177–183*).

Some germination studies on cereals, L. H. PAMMEL (*Proc. Soc. Prom. Agr. Sci., 1898, pp. 194–203*).—Notes are given on the effect of numerous factors on the germination of cereals. The germination of wheat as affected by latitude is commented upon and numerous studies given on the germination of corn.

Notes on the germination of seed within the fruit, J. C. COSTERUS (*Bot. Jaahrb., Dodonæa, 10 (1899), pp. 135–141, fig. 1*).—Attention is called to the germination of seed within various citrus and other fruits.

Concerning the quality and germinative ability of conifer seed, A. BURGERSTEIN (*Wiener Illus. Gart. Ztg., 24 (1899), No. 6, pp. 193–196*).

On the germination of Neotia nidus avis, M. BERNARD (*Compt. Rend. Acad. Sci. Paris, 128 (1899), No. 20, pp. 1253–1255*).—The author states that in the germination of the seed of this orchid, mycorrhizæ are absolutely indispensable. The symbiosis which is established is very complete, and it is probable that the seeds of most orchids are in this way able to germinate and grow in rather sterile soils.

Notes on the management of birch seed, W. SOMERVILLE (*Trans. Roy. Scottish Arbor. Soc., 15 (1898), pt. 3, p. 319*).—The seed are sown broadcast as soon as ripe in an open, moist but not wet seed bed, lightly covered with sand and rolled. The bed is kept moist by a covering of branches and watered if necessary. This covering must be removed when the seedlings begin to appear. A light cover of spruce leaves is needed as a winter protection. In this way the author says he never fails to obtain satisfactory results.

The weeds of New South Wales, J. H. MAIDEN (*Agr. Gaz. New South Wales, 10 (1899), No. 6, pp. 489–493, pl. 1*).—This is the beginning of a systematic enumeration of the weeds of the country. The plants are discussed botanically and economically and suggestions given for their eradication.

The use of chemicals for weed destruction, C. DUSSERRE (*Chron. Agr. Canton Vaud, 12 (1899), No. 12, pp. 265–268*).—Reports experiments with copper sulphate, iron sulphate, and sodium nitrate for the destruction of mustard in fields of cereals. Copper sulphate, 5 per cent solutions at the rate of 800 to 1,000 liters per hectare, will destroy the weeds without serious injury to the cereal crop. Iron sulphate is less efficient, requiring at least 30 per cent solutions. It is said that 1,000 liters of a 20 per cent solution of nitrate of soda will destroy the flowers and leaves of charlock but will not destroy seed already formed. It also has a strong fertilizing value. These treatments can only be given to cereals, being injurious to other crops.

DISEASES OF PLANTS.

Report of the botanists, L. R. JONES and W. A. ORTON (*Vermont Sta. Rpt. 1898, pp. 189–236, figs. 14*).—This contains a report on potato and apple diseases and their remedies, asparagus rust, club root of cabbage and turnip, a partial list of parasitic fungi of Vermont, notes on Vermont weeds, impurities of clover seed, and observations upon the causes and conditions of sap flow in the sugar maple.

During the season covered by this report the various forms of potato blights were recognized as seriously injurious to the foliage. Owing to the prevalence of cloudy weather, the plants at the beginning of August were in a state to be severely attacked by the tip burn. The advantage of Bordeaux mixture in preserving the general vigor of the plants and warding off disease was clearly shown. The fungus diseases made their appearance late in the summer, and were checked to some degree by the application of Bordeaux mixture. Experimental work with fungicides was carried on in two fields, which reemphasizes the fact that applications of Bordeaux mixture to potato foliage brings a large financial return.

Potato-scab experiments were conducted in which the relative merits of corrosive sublimate and formalin were compared, and in many ways the latter proved the more desirable as a preventive of the potato scab. In addition to having no retarding effect, formalin apparently slightly stimulated the growth of the potato plants.

Notes are given upon apple scab and apple scald. Spraying experiments were conducted for the prevention of apple scab in 1897, in which different applications of Bordeaux mixture and Paris green were compared. The results of the treatment are tabulated, from which it appears that those trees sprayed 3 times yielded about 3 times as much fruit as the checks. On those sprayed 5 times, the estimated value of the fruit was 7 times as great as of those receiving no treatment.

The attention of the station was again directed to the scald of apples, which is usually troublesome on the Rhode Island Greenings. A preliminary report of investigation of this disease has already been issued (E. S. R., 9, p. 847). From investigations carried on the last year, it appears probable that the primary cause of the scald must be sought in the climatic and orchard conditions, the condition of the storehouse being secondary.

The occurrence of the asparagus rust (*Puccinia asparagii*) in a number of gardens in the vicinity of the station in 1897 is reported. The disease is briefly described and remedial measures largely compiled from New Jersey Stations Report for 1896 (E. S. R., 9, p. 657) are given. Notes are also given on the club root of cabbage, specimens of which were received in August, 1897.

A partial list of the parasitic fungi of Vermont is given, together with the host plants of each.

Formalin for grain and potatoes, J. C. ARTHUR (*Indiana Sta. Bul. 77, pp. 38-44*).—The author briefly describes a number of smuts of cereals and also potato scab. It is suggested that the use of formalin for smut in wheat and oats, and for scab in potatoes, has been found by many trials to be one of the cheapest, simplest, and most efficient remedies yet suggested. A number of trials have been conducted with this fungicide, and data relative to its effect on wheat is given, in which it appears that so far as the seed grain is concerned a treatment of 2 hours in a solution of the strength of 1 lb. of formalin to 50 gal. of water is slightly, if at all, injurious to the growth of the plants.

In connection with the use of this substance for prevention of potato scab attention is called to the previous publications relative to the use of this fungicide (E. S. R., 9, p. 456; 10, p. 263), and the recommendations there given are repeated.

Further studies of cucumber, melon, and tomato diseases, A. D. SELBY (*Ohio Sta. Bul. 105, pp. 217-236, figs. 2*).—The prevalence of diseases of the cucurbits and tomatoes was discussed in Bulletin 87 of this station (E. S. R., 10, p. 361), and in 1898 further investigations were conducted for their prevention.

The principal disease this season, as formerly, was the downy mildew (*Plasmopara cubensis*), but owing to the earlier harvesting of the crop, the actual loss was less than the previous year.

The anthracnose of cucurbits has increased in abundance and destructiveness. A wilt of cucumbers and muskmelons due to a species of Fusarium has prevailed besides the usual bacterial wilt. *Phyllosticta cucurbitacearum* and *Cercospora cucurbitæ* are reported as spotting cucumber leaves, and *C. citrullina* as growing on watermelon foliage.

The practicability of saving the late crop of cucumbers from downy mildew by the use of Bordeaux mixture was fully demonstrated. Spraying for this purpose need not be begun earlier than July 25 or August 1. Bordeaux mixture is also recommended for the prevention of anthracnose, downy mildew, and leaf blight of muskmelons, although some failures are recorded.

The recommendations of previous bulletins relative to the treatment of tomato plants with Bordeaux mixture are again repeated.

Further studies upon spraying peach trees and upon diseases of the peach, A. D. SELBY (*Ohio Sta. Bul. 104, pp. 201–216, pls. 3*).—In continuation of experiments published in Bulletin 92 of this station (E. S. R., 10, p. 557) the author has given further studies upon the efficiency of spraying peach trees for the prevention of various diseases.

The peach-leaf curl is said to have been very destructive during 1898, and a further demonstration of the efficiency of spraying with Bordeaux mixture before the blossoms open was made. For this purpose applications should be made as early as April 12, and it is said the first spraying may be made successfully either in the fall or in March. Whale-oil soap is said to have considerable efficiency when applied as the buds are swelling, but is more expensive and not as efficient as Bordeaux mixture. Peach yellows was exceptionally virulent during the past season and the disease seems to be spreading throughout the orchards of the State.

Black rot in 1898, A. PRUNET (*Bul.* [*Min. Agr. France*], *18* (*1899*), *No. 2, pp. 265–286*).—The author states that black rot was less prevalent throughout France in 1898 than usual and attributes this to the unusual atmospheric conditions. In some regions it is thought that probably a parasite of the black-rot fungus also aided in checking the disease. The parasite, *Sporotrichum parasiticum*, is said to attack the sclerotia of the black rot, destroying them and rendering the spores incapable of germination.

Comparative studies were made of a number of fungicides, each being compared with some well-known fungicide and particularly with Bordeaux mixture. According to the nature of their active principles the different fungicides are grouped into 4 classes, those containing copper, copper and mercury fungicides, mercury alone, and those having nitrate of silver for their base. The mercuric and nitrate of silver fungicides proved rather injurious, and on the whole none of those tested showed any advantage over Bordeaux mixture.

The time of application of fungicides was again considered, and the investigations confirmed the results reported in 1897 (E. S. R., 9, p. 761). Experiments are briefly reviewed in which 4, 5, and 7 applications of fungicides were given grapevines. The different number of applications was somewhat dependent upon whether the attack of the previous year had been a severe one or not.

The forms of preservation and reproduction of black rot, J. PERRAUD (*Compt. Rend. Acad. Sci. Paris, 128 (1899), No. 20, pp. 1249–1251*).—The fungus causing grape black rot is known to be reproduced in a number of ways, namely, by means of pycnidia, spermagonia, perithecia, conidiophores, sclerotia, and mycelial spores analogous to chlamydospores. These, however, are not all forms which carry the fungus over from one year to another.

The author's investigations show that the particular forms concerned in the transition of the fungus from one year to another are the stylospores arising from the autumnal pycnidia, sclerotia, and perithecia. The winter spores of the pycnidia are borne principally upon the leaves, branches, and diseased wood. The perithecia and sclerotia exist mostly upon the fruit. ' The general practice, which has been recommended, of burying the diseased grapes can not, in the author's opinion, be considered except as one of several means for the destruction of the parasites. This method, he says, only destroys a greater or less number of germs, conditional upon whether the buried grapes shall not be uncovered by subsequent cultivation. From this it follows that the destruction of diseased leaves and vines and winter treatment of vines are quite necessary.

Aseptic treatment of vines, L. P. BARRETTO (*Rev. Vit., 10 (1898), p. 106; abs. in Ann. Agron., 25 (1899), No. 3, p. 141; Gard. Chron., 3. ser., 25 (1899), No. 611, p. 218*).—The author applies aseptic treatment to his vineyard. All old wood is decorticated, the whole stock disinfected, and the wires of the trellis sterilized by heat; all old dried leaves are burned, the posts are washed with copper solution, and the whole vineyard receives an application of copper salts as a preliminary operation. The author believes that perfect asepsis can be assured only on stony ground where there is but little moist, unwholesome exhalation and where disinfection can be easily effected. The above precautionary treatment yielded good results and the vines were preserved from rot. In another experiment, dusting with ammonium sulphate proved equally efficacious.

The mosaic disease of Holland tobacco, C. J. KÖNING (*Ztschr. Pflanzenkrank., 9 (1899), No. 2, pp. 65–80, pl. 1, figs. 2*).—A report is given of an extensive series of experiments made to ascertain the cause of the mosaic disease of tobacco. Diseased and sound leaves and plants were studied in many ways, but no specific organism could be found which was capable of producing the disease. Inoculation experiments with a number of suspected organisms were carried out but with negative results. The author was able to produce the disease upon sound plants only where the plant juices from diseased leaves were injected or otherwise introduced into sound leaves. Attempts were made to separate the active agent by means of glycerin and alcohol without success, as such extracts would not produce the disease, the "unknown virus," as it is called, probably being destroyed in this way.

Experiments are reported in which the effect of different fertilizers on the production of the disease is shown, the experiments in this case having been made upon plats of 0.5 hectare each. In these experiments where turf and horse manure were applied, the growth of the plants was good and only 3 per cent diseased, although all the suckers were affected. Turf and 500 kg. Peruvian guano produced good growth of plants with sound leaves, but 30 per cent of the suckers were spotted. Sheep manure produced good strong leaves, 2 per cent of which were diseased, and 15 per cent of the suckers. Turf and lime gave a good crop, but 7 per cent of the leaves and 40 per cent of the suckers were affected. The fertilizers in which kainit and Thomas slag were used produced good plants free from disease. The same may be said of pig manure and muck, with and without potash, and of horse manure, cow manure, and muck.

A living fluid contagium as the cause of the mosaic disease of tobacco leaves, M. W. BEIJERINCK (*Verhand. Konink. Akad. Wetensch. (Amsterdam), 2. sec., 6 (1898), No. 5, pp. 22, pls. 2; abs. in Jour. Roy. Micros. Soc. [London], 1899, No. 3, pp. 319, 320*).—The author, who has been investigating for some time the mosaic disease of tobacco leaves, reaches the conclusion that the disease is not due to bacteria, but to what he terms "a living fluid contagium." When passed through a porcelain filter, the juice of a diseased plant, although devoid of all bacteria, is found to retain its infective properties. The virus attacks only those tissues and organs which are in the most active condition of growth and of cell division. It is said to gain entrance either through the leaves or the roots and appears to be chiefly conveyed through phloem. The virus may be dried, may pass the winter in the soil, and an alcoholic extract may be dried at 40° C. without losing its infective power; but it is quickly destroyed by boiling. In the milder forms of the disease, the virus chiefly attacks the chlorophyll granules, but in the more severe cases the whole of the protoplasm is affected. In the mild type of the disease, the leaves in the earlier stages seem spotted with dark-green patches, which later become brown or orange-brown. In severe attacks, especially as a result of artificial infection, the leaves become malformed and monstrous. In some of the experiments the absence of chlorophyll was noted, and this was found to be due to the association of *Bacillus agglomerans* with the virus.

The author believes that a number of diseases of hitherto unexplained origin are due to this cause. Among them he mentions peach yellows and peach rosette.

Culture experiments with heterœcious rust fungi, H. Klebahn (*Ztschr. Pflanzenkrank., 9 (1899), Nos. 2, pp. 88–99; 3, pp. 137–160, figs. 4*).—Studies are given of the species of Melampsora, which infest various willows and Populus. A list is given of the heterœcious species, together with their æcidial, uredo, and teleutospore hosts; and notes are given of rusts occurring on Carex and Ribes; on Phalaris and Arum; on the specialization of *Puccinia smilacearum digraphidis;* on *P. orchidearum phalaridis;* on *P. moliniæ;* on *P. cari-bistortæ; P. polygoni*, and on *Phragmidium subcorticum.*

Diseased iris bulbs, G. Massee (*Gard. Chron., 3. ser., 25 (1899), No. 652, p. 412, fig. 1*).—The author reports having received from two widely separated localities iris bulbs which were attacked by a fungus. The parasite forms black patches on the surface of the bulb. These at first are small in size and few in number, but increase until finally the bulb presents a charred appearance. The fungus at first is quite superficial, but later the mycelium penetrates the tissues of the bulb, causing its decay.

If the attack is only superficial, soaking the bulbs for 1 hour in a solution of 1 part of formalin to 400 parts of water will destroy the fungus without injuring the bulbs. Where badly attacked, all bulbs should be burned.

The fungus causing this disease is said to be *Mystrosporum aductum*, n. sp. A technical description is given of the fungus, which is nearly related to a similar parasite of cultivated onions. The latter fungus (*M. alliorum*) differs in having smaller and minutely warted spores.

Botrytis cinerea as a hothouse pest, J. Beauverie (*Compt. Rend. Acad. Sci. Paris, 128 (1899), Nos. 13, pp. 846–849; 20, pp. 1251–1253*).—Under the name "Toile" the author describes a disease which has long been known to horticulturists as causing considerable destruction to seeds, seedlings, and cuttings in hothouses. The attacks are made by the mycelium of a sterile fungus which is scattered through the soil penetrating to some depth. The identity of the fungus has been a source of some discussion, and the author reports a series of experiments with *Botrytis cinerea* cultivated on carrots in a saturated atmosphere at a temperature of about 33° C. After cultivating this fungus for some time under the conditions in which the previously mentioned disease is known to occur, the author claims to have induced a disease corresponding exactly with that produced in the ordinary way.

The conidial form of the saprophyte became transformed into a sterile parasite and retained this form with considerable tenacity. The conditions favorable for the development of the sterile form are a high temperature, 30° C. or more, a humidity approaching saturation, a soil of mediocre fertility, and a confined atmosphere. These conditions are those most frequently met in propagating hothouses.

As means for preventing the attacks of this fungus the author cites experiments conducted in greenhouses at Luxemburg during the past 6 years, in which the soil was sterilized by heating with good results. Applications of a solution of copper sulphate and ammonia, it is thought, would also destroy the fungus in the soil.

Parasitic fungi, G. Lagerheim (*Bihang Svenska Vetensk. Akad. Handl., 24 (1898), No. 4, pp. 22, pls. 3; abs. in Jour. Roy. Micros. Soc.* [*London*], *1899, No. 4, p. 420*).—The occurrence of 2 new species of parasitic fungi is reported, namely, *Empusa phalangicida* on a Phalangid, as yet the only species discovered parasitic on other animals than insects; and *Iola lasioboli*, parasitic on *Lasiobolus equinus*, this being the first known example of a basidiomycete parasitic on a discomycete. The author also reports the occurrence of *Physoderma leproides* parasitic on alfalfa in Ecuador.

A partial list of the parasitic fungi of Vermont, W. A. Orton (*Contrib. Bot. Vermont, No 2, pp. 21*).—Reprinted from Vermont Station Report for 1898 (see p. 355).

Fungi of Colorado, Wyoming, and Nebraska, H. Hume (*Proc Davenport Acad. Sci., 7 (1899), pp. 246–257, pl. 1*).—Notes are given on collections made in these States during 1895–97, and *Puccinia crandallii* on the leaves and sheaths of *Festuca kingii*, and *Microstroma americanorum* on leaves of *Cnicus americanus* are described as new by Pammel and Hume.

Notes on plant enemies, K. Sajó (*Illus. Landw. Ztg., 19 (1899), No. 37, pp. 383–385*).—The author popularly describes a number of fungus diseases of cultivated plants and gives notes on injuries due to insects, worms, etc. Some relations between soils and diseases are pointed out.

The destruction of the smuts of cereal grains and the prevention of potato scab, H. L. Bolley (*North Dakota Sta. Bul. 37, pp. 363–379, figs. 3*).—This bulletin is intended to give a short statement of the diseases in question, outline the investigations of the station previously published, give statements of some of the results obtained in an attempt at prevention of disease, discuss methods of investigation, and suggest means for prevention. No new experimental data are introduced, most of the information being drawn from Bulletins 1, 19, and 27 of the station (E. S. R., 2, p. 740; 7, p. 39; 9, p. 143).

The rusts of our grain fields, O. Lugger (*Farm Student's Rev., 4 (1899), Nos. 9, pp. 138–140, figs. 3; 10, pp. 154, 155, figs. 6*).—Popular descriptions of the life history of cereal rusts.

Investigations on cereal rusts, Pommer (*Braunschw. Landw. Ztg., 67 (1899), No. 26, p. 121*).—Notes the prospective study of the subject of cereal rusts.

Rusts and similar diseases of cereals (*Braunschw. Landw. Ztg., 67 (1899), No. 26, pp. 121, 122*).—Brief notes on the causes of a number of diseases of cereals and the amount of injury done to the crops.

The rusts and smuts of cereals, G. Lafosse (*Rev. Sci.* [*Paris*], *4. ser., 11 (1899), No. 16, pp. 493–498*).—A résumé of the present state of information of the rusts and smuts of cereals.

The smuts of cereals and their prevention, Tancré (*Landw. Wchnbl. Schleswig-Holstein, 49 (1899), No. 29, pp. 540–544*).—Notes are given on *Ustilago carbo*, *U. destruens*, *U. maydis*, *Tilletia caries*, *T. lævis*, and *Urocystis occulta*, and recommends soaking seed grain in copper sulphate solutions as a preventive measure for most of the fungi.

Wheat smut, its cause and means for prevention (*Bol. Soc. Agr. Mexicana, 23 (1899), No. 32, pp. 636–638*).—Describes *Tilletia caries* and recommends treating seed with copper sulphate solutions prior to sowing.

Influence of soaking cereals in copper sulphate solutions on germination, K. Kittlausz (*Fühling's Landw. Ztg., 48 (1899), Nos. 15, pp. 572–586; 16, pp. 605–616*).—The effect on the germination of soaking rye, oats, barley, and wheat in different strengths of solution and for different lengths of time is shown.

Fungus diseases of grapes, A. A. YACHEVSKY (*St. Petersburg: Min. Agr. and Imp. Domains, Dept. Agr., 1899, pp. 83, pls. 5, figs. 18; rev. in Selsk. Khoz. i Lyesov., 194 (1899), July, p. 180*).—Notes are given on a number of the more destructive parasitic diseases of the grape. The life histories of the fungi are described and suggestions given for combating their attacks.

Report on the inspection of the Trans-Caspian Province and Turkestan vineyards in 1898 (*Selsk. Khoz. i Lyesov., 194 (1899), July, pp. 55–58*).—Notes are given on a number of well-known fungi that were observed on the grapevines, and mention is made of several other species which are thought to be new to science. No descriptions are given of the latter.

Brunissure and its causes, V. DUCOMET (*Prog. Agr. et Vit. (Éd. L'Est), 20 (1899), No. 33, pp. 198–204*).—It is claimed that as a rule brunissure is not of parasitic origin but is due to unfavorable soil and weather conditions. It may sometimes be caused by fungi, but rarely.

Report of investigations on black rot in 1898, A. PRUNET (*Prog. Agr. et Vit. (Éd. L'Est), 30 (1899), No. 30, pp. 108–119, figs. 3*).—In continuation of investigations begun in 1897 (E. S. R., 9, p. 959) the author has studied the most advantageous times for the application of fungicides, and the previous observations are confirmed.

On the use of copper sulphate for combating grape Peronospora, G. CUBONI (*Extr. from Sup. Bol. Soc. Agr., 1899, Apr. 15*).—An address before the Italian Agricultural Society.

A new remedy for combating grape mildew, J. DUFOUR (*Chron. Agr. Cant. Vaud, 12 (1899), No. 13, pp. 304–306*).—A mixture of black soap 1 kg., potassium sulphid 500 gm., and water 100 liters is recommended.

A core rot and blackening of horse-radish, P. SORAUER (*Ztschr. Pflanzenkrank., 9 (1899), No. 3, pp. 132–137, pl. 1*).—A description is given of a disease of horse-radish in which the central cylinder of the root is blackened and a sort of gummosis produced.

The mosaic disease of tobacco, R. FRANCÉ (*Kisérletügyi Kozlemények, 2 (1899), No. 4, pp. 198–204, pls. 2*).—Notes are given on the causes of the mosaic disease of tobacco and the anatomical changes produced by it. Among the causes discussed are insects, fungi, and bacteria, the author believing the disease to be due to the latter cause.

Leaf spot of the olive, V. PEGLION (*Separate from Bol. Soc. Agr., 1899, pp. 7*).—Notes are given of the leaf spot of olives, which is said to be due to *Cycloconium oleaginum*.

Coffee disease in Nicaragua, G. MASSEE (*Bul. Roy. Bot. Gard. Trinidad, 3 (1899), No. 20, p. 182*).—The author identifies as *Stilbum flavidum* the fungus which seriously attacks coffee leaves in Nicaragua, and recommends spraying with Bordeaux mixture and burning diseased foliage as preventive agencies to be adopted.

The cacao pod disease (*Bul. Roy. Bot. Gard. Trinidad, 3 (1899), No. 20, pp. 183–185, fig. 1*).—This disease, which was previously noted (E. S. R., 11, p. 166), is said to be due to attacks of *Phytophthora omnivora*. Associated with it is another, *Nectria bainii*, described as a new species by Massee. The relationship between the two fungi is as yet unknown. The disease is said to cause a depreciation of fully 25 per cent in the fermented and dried beans.

Some climatic and fungus diseases of the chestnut, G. H. POWELL (*Amer. Gard., 20 (1899), No. 242, p. 579, figs. 2*).—Notes are given of a body blight of chestnut trunks, a disease of leaves due to some undetermined fungus, sun scald, etc.

ENTOMOLOGY.

Some insects injurious to garden and orchard crops, F. H. CHITTENDEN (*U. S. Dept. Agr., Division of Entomology Bul. 19, n. ser., pp. 99, figs. 20*).—*The squash ladybird* (*Epilachna borealis*); *its literature and biology*.—The article contains an account of the appearance and distribution of this herbivorous ladybird. Its food plants are pumpkin, cantaloupe, watermelon, cucumber, prickly cucumber (*Echinocystis lobata*), and the one-seeded bur cucumber (*Sicyos angulatus*). The larva has the habit of marking out circular patches on the leaves, within which it feeds. The eggs hatch in 7 days, the larvæ mature in 16 days, and the pupal period extends over 6 days, giving a total of 29 days from egg to beetle. The evidence goes to show that the species is single brooded. Among its natural enemies are mentioned *Podisus spinosus* and *Euphorocera claripennis*. The beetle can be controlled by application of arsenites or by hand picking of the adults and egg masses.

The history of the common squash bug (*Anasa tristis*).—The author has discovered a fifth immature stage in this species, making five distinct stages beside the egg and the adult. Technical descriptions are given of the egg and the five immature stages, as well as the adult. The life cycle from the egg to the adult requires 4 weeks, or in some cases from 32 to 34 days. The insect is considered as single brooded. Among its enemies are numbered toads, lizards (*Sceloporus undulatus*). Two egg parasites are mentioned, *Hadronotus anasæ* and *Ooencyrtus anasæ*. This species has pushed north as far as Orono, Me. Young plants may be protected with covers or by means of repellents, such as land plaster or gypsum saturated with kerosene or turpentine. The vines should be gathered and burned as soon as the crop is harvested.

The horned squash bug (*Anasa armigera*).—A detailed description of this species is given, so as to distinguish it from the last-named species. It has five immature stages. The minimum period of the entire life cycle is 32 days. The egg masses are smaller than those of *A. tristis*, numbering not more than 20. There is but a single generation annually. This insect probably has the same natural enemies as has *A. tristis*. A few late squashes may be set out as a trap crop, and these may then be sprayed for the destruction of the squash bugs which will have gathered upon them.

Some observations in the life history of the squash-vine borer (*Melittia satyriniformis*).—A technical description of the egg is given for the first time. The author describes also the larva and its different stages, as well as cocoon, chrysalis, and moth. The species is partially double brooded in the District of Columbia, normally two brooded in the Gulf States, and single brooded in the North. The remedies which are found to have most value are harrowing of infested fields late in the fall and plowing deeply in spring, or the reversal of this process, to prevent the moths from issuing. Dead vines and old plants should be destroyed as soon as the crop is harvested.

Notes on the pickle worm (*Margaronia nitidalis*).—This insect was observed to eat holes in muskmelons and cantaloupes and related plants. A larva transformed to a chrysalis on October 5 issued as an adult on the 25th of the same month, thus requiring 20 days for the chrysalis condition. The larvæ seem to feed first upon the leaves, and later to bore into the leafstalks.

The melon caterpillar (*Margaronia hyalinata*).—This insect was taken in the District of Columbia for the first time in the fall of last year. It is reported from all the Gulf States and from the District of Columbia to Texas, as well as in Columbus, Ohio, Buffalo, N. Y., and Hamilton, Canada. While the larvæ are feeding upon the foliage or upon the outside of the stem, they may be readily destroyed by the use of Paris green.

The northern leaf-footed plant bug (*Leptoglossus oppositus*).—This insect resembles in its habits the squash bug. It has been reported as injurious from Tennallytown, D. C., and from Keedysville, Md.

The banded leaf-footed plant bug (*Leptoglossus phyllopus*).—This insect is reported as injuring oranges, as well as the strawberry, peach, plum, currant, eggplant, and cotton bolls. Its normal food plant is the yellow thistle (*Carduus spinosissimus*). Its distribution includes the entire Gulf region, as well as Arizona, Missouri, and the Indian Territory. Both of these plant bugs may be hand picked or captured in inverted umbrellas or in bags saturated with kerosene. The yellow thistle may be planted about the garden as a trap crop.

Notes on the striped cucumber beetle (*Diabrotica vittata*).—A technical description of the egg is given for the first time. As deterrents are mentioned sulphur, plaster, and ashes dusted upon the leaves. Paris green is also effective when the insects are on the surface of the leaf. Kerosene emulsion and pyrethrum have also been used with good success. The wild cucumber (*Echinocystis lobata*) could be planted as a trap crop.

A new webworm enemy of the cabbage and other cruciferous plants (*Hellula undalis*).—The species is recorded as injuring cabbage, turnips, beets, etc. The moth is reported as laying its eggs in the heart of the cabbage and other vegetables, and the larvæ are said to twist the leaves so as to inclose themselves. The insect is a European importation. A technical description is given of the moth, larva, and pupa. It is now distributed in the Lower Austral region and will probably extend into the Upper Austral. A tachina fly (*Exorista piste*) has been reared from the caterpillar of this insect as well as the Ichneumonid fly (*Limneria tibiator*). Paris green applied as a spray in the proportion of 1 lb. to 150 gal. of water should be effective in the destruction of this webworm.

Notes on the garden flea hopper (*Halticus uhleri*).—The species is reported as injurious to smilax, late potatoes, tomatoes, beans, peas, and cowpeas, and especially to beans. A large number of native weeds and plants are also frequented by this insect and serve as its food plants. The author gives a description of the insect in several stages, and calls attention to deficiencies in our knowledge of its life history. Kerosene emulsion sprayed directly upon the insects is effective in their destruction.

The imbricated snout beetle (*Epicærus imbricatus*).—This beetle is recorded as injuring strawberry plants, eating the leaves and afterwards the whole stem. A careful description of the insect in its various stages is added. An individual beetle under observation lived, as the author states, "an active life of 57 days in addition to the time before and during hibernation. In this time she deposited eggs almost daily. It will be seen by the above figures that a total of 540 eggs were laid in this time, and it is probable that the entire quota might reach as high as 600." Arsenicals applied either dry or as a spray at a rate of 1 lb. to 100 gal. of water are effective remedies against this beetle.

The brown fruit chafer (*Euphoria inda*).—The insect is described in all of its stages from egg to adult and a record is given of its egg-laying habits. Regarding the larval condition, the author reports experiments which show conclusively that the larva is not injurious, its food being confined to decaying vegetation and manure. Egg-laying begins about the first of May. The eggs hatch in about 11 days and the life cycle from the deposition of the egg to maturity of the beetle is about 12 weeks. The author believes that the reports of injuries by the adult beetle are considerably exaggerated. The beetle is recorded as injurious to peaches, apples, tomatoes, cotton bolls, and various fruits. Among its natural enemies is the *Typhia ornata*. The beetles may be readily captured by jarring into bags or nets.

Brief notes on the May beetle (*Lachnosterna arcuata*).—Technical descriptions are given of the egg, larva, pupa, and adult. Rearing experiments gave a total life period of 2 years and 51 days from the egg-laying until the issuance of the adult beetle. The beetles are recorded as particularly injurious to sugar maple, having gouged out portions of the leaves and even cutting off the leaves from the trees. As parasites of the white grub are mentioned *Ophion bifoveolatum*, *Pelecinus polyturator*, *Cryptomeigenia theutis*, *Microphthalma disjuncta*. *Drasterius elegans* and *Tetramorium cæspitum* are reported as preying on the white grubs. Bisulphid of carbon and bran-arsenic mash are considered the most effective remedies.

The spinach flea-beetle (*Disonycha xanthomelæna*).—This insect is recorded as living upon the common chickweed (*Stellaria media*). Careful descriptions are given of the egg and the larva. Its only natural enemy so far known is *Hypostena barbata*. The arsenites are the best remedies against this insect.

The tobacco flea-beetle (*Epitrix parvula*).—The author gives an account of recent injuries by this insect. The full life cycle is reported as requiring 28 days. The food plants of this insect belong to the Solanum family.

The eggplant flea-beetle (*Epitrix fuscula*).—A description of the egg is given for the first time. The insect is reported as attacking the leaves of the eggplant. It is said to infest also the strawberry and potato. Its distribution is from New Jersey to Georgia and across the continent.

The cucumber flea-beetle (*Epitrix cucumeris*).—This beetle is recorded as destructive to tomatoes. Its food plants all belong to the order Solanaceæ. As remedies pyrethrum and Paris green are mentioned as well as the growing of trap crops of jimson weed.

The cherry-leaf beetle (*Galerucella cavicollis*).—This beetle is recorded as eating holes in the leaves of cherry trees and as damaging the foliage of peach trees. A description is given of the adult beetle and of the larva and egg. An arsenical spray will be found to be an efficient remedy.

The plum-leaf beetle (*Nodonota tristis*).—This beetle was noticed feeding upon plum trees, peach, apple, cherry, and choke-cherry. Eggs were deposited side by side in a fold of the leaf in irregular rows.

The rose-leaf beetle (*Nodonota puncticollis*).—This beetle is recorded as injurious to roses and ornamental willows. Eggs were deposited in the same manner as in *N. tristis.* A beetle was found upon which was a larval mite *Eupalpus echinatus.* As these beetles do not fly readily, they may be captured by jarring them into inverted umbrellas, or other similar appliances, saturated with kerosene.

The fruit-tree bark beetle (*Scolytus rugulosus*).—This beetle is recorded as attacking mountain ash and Juneberry. Kerosene rubbed upon the trunk and large branches of trees infested with this beetle proved an efficient remedy in destroying the beetles and did not injure the trees.

The banded hickory borer (*Chion cinctus*).—This insect was found at work in the branches of plum trees at Colonial Beach, Va.

The grape-cane borer (*Amphicerus bicaudatus*).—This beetle is recorded as injuring ash-wood lumber and is also recorded as having attacked living green ash (*Fraxinus viridis*).

The eye-spotted apple-twig borer (*Oberea ocellata*).—This species is reported from Boerne, Tex., as being found in large numbers in the tips of branches of peach and plum trees. The beetle is said to attack the pear tree also and poison sumac.

Notes on insect pests from the entomological section, Indian Museum, E. BARLOW (*Indian Mus. Notes, 4 (1899), No. 3, pp. 118–142*).—The notes include a number of studies and experiments with tea pests, insects destructive to cereals, forest insects, fruit-tree insects, as well as remarks on the value of certain insecticides. The use of arsenic is recorded as being very effective in the destruction of locusts. It was applied as follows:

> "Take 1 lb. arsenic, 1 lb. caustic soda. Take 4 gal. of water, bring to boiling point, add the caustic soda; when dissolved, add the arsenic, stir well and boil for a few minutes, care being taken not to inhale the fumes. Keep this mixture under lock and key. Take as required half a gallon of this mixture and add 4 gal. of hot or cold water and 10 lbs. of brown sugar. Dip bagass, grass, or mealie stalks in this liquor and place along roads, in canefields, or anywhere about grass or low-growing crops, or splash with a whitewash brush onto anything which the locusts may be observed to have a taste for. Locusts will come from a hundred yards or more, attracted by the smell of the sugar. They eat and die, and are eaten by other locusts."

Experiments were tried in storing cereals in pits to prevent the attacks of weevils. Only partial success is recorded, many of the pits having proved too moist for the grain. In some pits charcoal was placed in the bottom, and in others quicklime, care being taken to prevent the contact of the grain with the lime. The weevils were thereby prevented from doing injury to the grain.

The tarnished plant bug, J. M. STEDMAN (*Missouri Sta. Bul. 47, pp. 77–87, figs. 3*).—This insect is said to be practically free from the attacks of all predaceous and parasitic insects. The pest attacks nearly all garden and field crops, as well as a large variety of uncultivated plants. Its depredations are perhaps most seriously felt by the nurserymen and fruit growers, since it attacks the young developing fruit buds of nearly all kinds. When the young buds are punctured and the sap sucked out by these insects, the buds turn black and die, or fall off. The result is a serious check on the growth of the plant.

The peach, pear, and apple are reported as suffering most severely, but the plum, quince, and cherry are also seriously injured. Small fruits suffer badly, the grape, raspberry, currant, blackberry, gooseberry, and strawberry receiving most injury. The author believes that the chief cause of the buttoning of strawberries is the attack of this bug. Experiments with insecticides showed that those portions of the strawberry field which were best protected from the attacks of this insect exhibited the least buttoning.

The author describes the 4 immature and adult stages of the insect. On account of the great variety of food plants, it is especially difficult to control by insecticides. The burning of rubbish along fences and fields late in the fall is suggested as a palliative remedy. Good success is reported from the use of a large butterfly net in sweeping small fruit trees and bushes in the early morning before the bugs have become active. On larger trees kerosene emulsion was used with good results. If the force pump with kerosene attachment is used, it should be set so as to discharge a spray of 8 per cent kerosene. The emulsion should be applied early in the morning while the bugs are stupid. In the case of strawberries the kerosene emulsion can not be used, for the reason that the strawberries would thus be tainted. Pyrethrum is the best remedy in this case. It may be used dry mixed with four times its weight of common wheat flour, and applied in the early morning while the dew is on, or as a spray in the proportion of 1 lb. of pyrethrum for every 15 gal. of water. A remedy known as rose-leaf insecticide, a patent preparation of tobacco, was tried with good success.

The grape-berry moth (Polychrosis (Eudemis) botrana), G. DEL GUERCIO (*Nuove Relaz. R. Staz. Ent. Agr., 1. ser., 1899, No. 1, pp. 117–193, figs. 28*).—This article gives a rather exhaustive account of the grape-berry moth, including a discussion of the egg, larva, chrysalis, moth, and the habits and metamorphosis of the species. Besides the grape, the insect is found upon *Lyriodendron tulipifera, Rosmarinus officinalis*, and *Daphne gnidium*. The author discusses the nature and extent of damages done by this insect, as well as climatic and other conditions which are favorable or unfavorable to its development. The parasitic and predaceous insects which are the enemies of the grapeberry moth are discussed and figured. Two fungus parasites are found upon the insect in question, *Botrytis bassiana* and *Isaria farinosa.*

Numerous experiments were conducted in the destruction of the insect in all its stages, and formulas are given for making various emulsions of alcohol, soap, benzin, and pyrethrum. There are three broods of larvæ from the last of April until the end of October. One brood is found upon the flower buds and flowers, one in the small and medium-size grapes, and the third in the mature or nearly mature grapes. The first brood pupate in the margin of the leaves, the second among the desiccated grapes, and the the third under the bark of the stems. These last pupæ pass the winter as such. The insect does not hibernate in the egg or larval condition. The author recommends especially the spraying of the infested flowers by the use of an alcoholic emulsion of soap with benzin and pyrethrum. It is also recommended that the larvæ or chrysalids should be destroyed in the grapes, and that when the infestation is unusually bad, the grapes should be gathered earlier than usual. The hibernating chrysalids may also be easily destroyed. The choice of methods of destruction by mechanical means or manual labor, or by application of insecticides, will depend upon the price of insecticides and manual labor in the particular locality.

Emergency report on tent caterpillars, M. V. SLINGERLAND (*New York Cornell Sta. Bul. 170, pp. 553-564, figs. 4*).—This bulletin contains a brief account of the appearance and habits of the apple tent caterpillar and forest tent caterpillar. The different stages of the insect are figured. The remedies recommended against the apple tent caterpillar are the destruction of the tents upon wild-cherry trees, the collection of the egg masses by school children, and spraying with Bordeaux mixture to which Paris green has been added in the proportion of 1 lb. to 150 gal. of Bordeaux mixture.

The remedies which are suggested to be used against the forest tent caterpillars are the destruction of the egg masses and jarring the caterpillars from the trees after the trees have been banded with tarred paper or otherwise, so that the caterpillars can not climb the trees again.

Legislation against crop pests—dangerous pests prescribed by the board with remedial suggestions, W. M. SCOTT (*Georgia State Bd. Ent. Bul. 1, pp. 32, figs. 7*).—This bulletin contains a copy of amendments to the State law regulating the department of horticulture, State entomologist, and fruit tree and nursery inspection. It also gives a list of the rules adopted by the board of entomology for the guidance of the State entomologist in the enforcement of the act of the general assembly of Georgia.

The list of dangerously injurious pests as adopted by the board is as follows: San José scale, new peach scale (*Diaspis amygdali*), cabbage webworm (*Hellula undalis*), black knot, peach yellows, peach and plum rosette, and mistletoe.

Concerning the San José scale, the author gives an account of its appearance and the method of its attacks. Its food plants are listed and it is reported from 30 counties of the State. The ordinary fumigation with hydrocyanic-acid gas, mechanical mixtures of kerosene and water, and of whale-oil soap are described. The author relates that the San José scale suffered severely and a large percentage was destroyed by low temperature during February. The temperature was from —4 to —8° F., and it was noted that the San José scale suffered much more severely than the Forbes scale.

The new peach scale is figured and described and the usual remedies recommended. There are said to be from 3 to 4 broods from the eggs in Georgia. At the time of the appearance of any brood, the author recommends the application of a 10 per cent kerosene wash or whale-oil soap at the rate of 1 lb. to 4 gal. of water. This scale is reported to have been almost annihilated by the February freeze.

The cabbage webworm (*Hellula undalis*) is reported as being one of the most destructive enemies to cultivated cruciferæ, some gardeners having found it almost impossible to raise turnips, cabbages, radishes, or other cruciferous vegetables with any profit on account of the destructiveness of this insect. The insect is described in all of its stages, and an account is given of its life history and habits. The moth deposits the eggs singly. Each moth lays from 20 to 30 eggs. The eggs hatch within 2 to 3 days, and the young larvæ spin a slight web and roll the leaves partially together as a means of protection. As the larvæ become older, they spin a bag in which they are rather effectively concealed. In the laboratory the larvæ require from 20 to 25 days to develop. The cocoons are formed on the leaf of the plant or beneath the sand. The pupal stage lasts from 10 to 12 days. The moths fly in the evening after sunset and deposit their eggs on the under surface of the leaves. The complete life cycle of the insect is less than 6 weeks, and the author believes that there are 3 broods annually in the State. While the author has not experimented extensively with remedies, he believes that Paris green sprayed upon the plants in a judicious manner will be effective in checking the attacks of this insect. The use of lantern traps is also recommended, and the burning of all trash, as weeds and cabbage stalks, during the winter.

The author gives notes of a biological and economic nature on black knot, peach yellows, and peach and plum rosette, with suggestions of the usual remedies.

For checking the attacks of mistletoe, it is recommended that small twigs which are attacked by the plant should be removed and burned and that the mistletoe should be dug out of larger branches which it infests during the winter.

Apiculture by simple methods, R. Hommell (*L'Apiculture par les méthodes simples. Pp. 338, pls. 6, figs. 102; abs. in Jour. Agr. Prat., 1899, II, No. 36, p. 357*).—This work contains chapters on the biology of bees, honey, honey plants, the growth of colonies, swarming, management of bees, their diseases and statistics. The main purpose of the book, as the author states, is to outline methods of bee culture which are so simple as to appeal to every one.

Foul brood (*Rev. Internat. Apicult., 21 (1899), No. 8, pp. 153–163*).—A discussion by a number of authors of various remedies and methods to be adopted in combating this disease.

Experiments in bee keeping, C. R. Peck (*Vermont Sta. Rpt. 1898, pp. 307–309*).—An experiment was tried in moving queens during the honey flow. The swarms thus treated were so disturbed that they made less honey than undisturbed swarms. Extracted honey was fed back to a number of swarms with results which indicate that the procedure is of questionable value.

An undescribed parasitic disease of the silkworm, E. Verson (*Un'Affezione parassitaria del Filugello non descritta ancora, XIII, Padova, 1899, pp. 11, pl. 1; separate from R Stazione Bacologica Sperimentale*).—The author describes an apparently new bacterial disease of the silkworm. The disease may not prove fatal to the caterpillar, but the chrysalids and adults from diseased caterpillars may be easily recognized by the modification of their color, the adult showing a lead color.

Beneficial insects, E. D. Sanderson (*Amer. Farmer Mag., 6 (1899), No. 2, pp. 120–124, figs. 7*).—Popular notes on predaceous and parasitic insects.

Insects—Part II, D. Sharp (*London and New York: Macmillan Company, 1899, pp. XII+626, ills.*).—This part of the author's work on insects treats of the remainder of the Hymenoptera, Coleoptera, Lepidoptera, Diptera, Thysanoptera, and Hemiptera. The anatomy, development, and metamorphosis of the insects are thoroughly discussed in connection with each group.

Injuries done by insects in the country, E. D. Sanderson (*Amer. Farm. Mag., 6 (1899), No. 1, pp. 8–11, figs. 9*).—Popular notes on estimations of losses from the depredations of insects.

Report on the entomological work, L. Zehntner (*Verslag. Proefsta. Suikkerriet. West-Java, 1898, pp. 80–92*).—This article contains an account of the outbreaks of a number of injurious insects and of the work of the entomological department in general.

Entomology, L. Bruner (*Nebraska Sta. Rpt. 1898, pp. XXXVII–XLII*).—The report contains brief notes on the native grasshoppers of the State, with references to experiments with the South American grasshopper disease, notes on the chinch bug, the fall webworm, the spring cankerworm, onion thrips, melon louse, and the San José scale. The latter is said not to have been found in the State thus far.

Report of the entomological section, C. P. Gillette (*Colorado Sta. Rpt. 1898, pp. 161–165*).—Three remedies were tried for the codling moth—the daily gathering of fallen apples, catching the larvæ under bandages, and two sprayings with Paris green. The latter method was far the most effective. Notes are given on the study of the native grasshoppers, scab mite of sheep, insecticide tests, and experiments in the apiary.

Insect pests of 1898, M. V. Slingerland (*Proc. West. New York Hort. Soc., 1899, pp. 71–77*).—Notes on pear Psylla, tent caterpillars, cankerworms, and the grapevine flea-beetle.

Diseases and injuries of fruit trees, O. Kirchner and H. Boltshauser (*Atlas d. Krankheiten u. Beschädigungen unserer landwirtschaftlichen Kulturpflanzen. Series V: Obstbäume. Stuttgart: E. Ulmer, 1899*).—This part of the atlas contains 30 plates illustrating insect and fungus diseases of fruit trees. Brief biological notes are given together with suggestions of proper remedies.

Three insect enemies of shade trees, L. O. Howard (*U. S. Dept. Agr., Farmers' Bul. 99, pp. 30, figs. 11*).—This is a reprint with some annotations of an article by the same author in the Yearbook of this Department for 1895 (E. S. R., 8, p. 804).

Insects and other arthropods injurious to plants, A. De Scabra (*Arch. Rural, Portugal, 4 (1899), No. 8, pp. 120–123*).—Brief notes on *Melolontha vulgaris*, *Agrotis segetum*, *Aphis phaseoli*, and *A. fabæ*.

Some prune pests, A. B. CORDLEY (*Oregon Bd. Hort. Rpt. 1898, pp. 417-432*).—An account of the peach-tree borer, San José scale, and brown rot.

The codling moth, J. R. CASEY (*Oregon Bd. Hort. Rpt. 1898, pp. 413-416*).—A report on some experiments in banding trees in order to prevent injuries by this insect.

On the destruction of hazel trees in the Crimea by Lecanium corni, S. MOKRZETSKI (*Selsk. Klroz. i Lyesov., 192 (1899), Feb., pp. 413-420*).

The destruction of acorns and pine seeds by Gastropacha quercus and methods of preventing its injuries, ALTUM (*Ztschr. Forst u. Jagdw., 31 (1899), No. 1, pp. 35-44*).—Recommends the destruction of the caterpillars, harrowing of places badly infested, rolling the ground, and the use of Raupenleim.

Everyday butterflies—a group of biographies, S. H. SCUDDER (*Boston: Houghton, Mifflin & Co., 1899, pp. 391, pls. 9, figs. 47*).—This volume treats of the common butterflies of the eastern United States and Canada. The number of species about which observations are made is 62. The greater number of the species are figured and all are described in a general way, and notes are given concerning the life history and habits, food plants, and breeding places of all of the species.

The gray field slug (Limax agrestis), SCHMOLDT (*Fühling's Landw. Ztg., 48 (1899), No. 13, pp. 487-490*).—The paper discusses the habits and biological relationships of this slug, and contains accounts of the appearance of immense numbers of the slug at certain seasons. The natural enemies which are mentioned are the moles, shrews, crows, starlings, and toads.

The remedies which are suggested for fighting the slug on a large scale are all of the nature of an irritant upon the skin. The slug requires moist conditions and when any substance comes in contact with the skin which has a strong attraction for water, the body of the slug loses moisture rapidly and is much weakened or killed. The author recommends the sprinkling of salt upon the slugs. It is also stated that the scattering of grains in the field where the slugs are abundant is an effective remedy, the grains adhering to the skin of the slugs, causing excessive irritation of the skin with consequent formation of large quantities of mucus.

The hamster in Belgium, G. STAES (*Tijdschr. Plantenziekten, 4 (1898), No. 6, pp. 173-192, figs. 3*).—The common hamster (*Cricetus frumentarius*) is described, and an account is given of its habits and injuries to crops. Its natural enemies are *Martes foina*, *M. putorius*, and *Mustela vulgaris*. Poisoning by various methods and fumigation are the remedies recommended for use against it.

A revision of the genus Hydrœcia, J. B. SMITH (*Trans. Amer. Ent. Soc., 26 (1899), No. 1, pp. 1-48, pls. 2*).—The author describes 36 species of this genus in a monographic arrangement with bibliographical references to the original descriptions.

Spraying for profit, H. E. WEED (*Griffin, Ga.: Horticultural Publishing Co., 1899, pp. 72, figs. 37*).—A handbook of practical information regarding the insects and fungus diseases which are most common and most destructive, the various insecticides which have been found most effective in controlling these pests, and the spraying pumps and machinery which are most convenient and suitable for this work.

Spraying—when, how, and why, A. W. BRYANT (*Trans. Illinois State Hort. Soc., 1898, pp. 253-261*).—The writer classifies insects according to their feeding habits, and gives directions for preparing Paris-green solutions, Bordeaux mixture, and kerosene emulsion.

Insecticides and fungicides, E. E. FAVILLE (*Trans. Kansas State Hort. Soc., 23 (1898), pp. 90-94*).—The paper contains popular notes on spraying of fruit trees and garden vegetables.

Tests with phosphocarbid of calcium in 1898, E. CHUARD (*Chron. Agr. Canton Vaud, 12 (1899), No. 11, pp. 243-247*).—This substance holds phylloxera in check, but can not be relied upon for complete extermination of these insects like bisulphid of carbon.

The perfecting of the method of treatment against Cochylis (*Prog. Agr. et Vit., 20 (1899), No. 27, pp. 3, 4*).—Recommends the following insecticide: Water, 100 liters; turpentine, 2 kilos; soft soap, 3 kilos.

Experiments in cyaniding oranges, A. H. BENSON and H. TRYON (*Queensland Agr. Jour., 4 (1899), No. 6, pp. 450–456*).—The treatments recorded in this paper were made against *Aspidiotus ficus, Chionaspis citri,* and *Mytilaspis gloveri.* The results of the experiments were as follows: Hydrocyanic-acid gas, even in a very dilute state, destroyed all the scale insects in both mature and larval conditions when they were confined in it for 1 hour The greater number of the eggs were also destroyed.

Dry rubbing of fruit to remove the scale insects injures the skin so that the gas acts upon the substance of the orange and discolors it. Drops of water on the fruit absorb the gas and may cause discoloration. It is not necessary to use 5 fluid oz. of sulphuric acid and 10 fluid oz. of water to generate the gas from 1 oz. of 98 per cent cyanid of potassium.

Annual report of the special committee for plant protection for 1898, FRANK and SORAUER (*Arb. Deut. Landw. Gesell., No. 38, pp. 197*).—This report contains brief notes and suggestions of remedies for a great variety of injurious insects, birds, mice, nematode worms, and rabbits. The injurious animals are arranged in lists under the name of the plants which they damage.

FOODS—ANIMAL PRODUCTION.

Description of a new respiration calorimeter, and experiments on the conservation of energy in the human body, W. O. ATWATER and E. B. ROSA (*U. S. Dept. Agr., Office of Experiment Stations Bul. 63, pp. 94, pls. 8, figs. 12*).—In a previous publication (E. S. R., 9, p. 863), that portion of the respiration calorimeter which had to do with the income and outgo of matter was described. The present bulletin describes the special devices which have to do with the income and outgo of energy, and reports 2 experiments in which the balance of matter and energy was determined, as well as a number of check experiments in which the accuracy of the apparatus was tested by means of heat generated by an electric current and by alcohol burned inside the respiration chamber.

The respiration chamber has 2 metal walls, one of zinc and the other of copper. These are protected by 3 walls of wood with air spaces between. The metal walls are maintained at the same temperature; hence no heat can pass in or out of the respiration chamber. The heat given off from the body of the subject in the respiration chamber and that due to external muscular work performed by the man inside the chamber is carried off by a current of cold water which passes through a series of pipes inside the chamber.

"By regulating the temperature of this water current as it enters and also its rate of flow, it is possible to carry away the heat just as fast as it is generated and thus maintain a constant temperature inside the chamber. The amount of the outgoing water and its increase in temperature are measured, thus determining the amount of heat carried away.

"In order that the heat taken up by the absorbers and carried out by the water current shall represent exactly the amount given off from the man's body or otherwise produced in the chamber, it is necessary to provide that there shall be no passage of heat through the walls, or rather, that the small quantities that may pass in and out shall exactly counterbalance each other, and that the ventilating current of air shall leave the chamber at the same temperature as it enters, so that it shall carry out neither more nor less heat than it brings in. The excess of water vapor in the air leaving the chamber over that in the air entering represents water given off from the body of the subject, and the heat required to vaporize it must be added to the heat carried off by the current of water to obtain a measure of the total heat given off by the subject. . . .

"In some of the experiments the man had as little muscular exercise as practicable. In these so-called rest experiments no attempt was made to measure the muscular work. In others, so-called work experiments, the amount of work done was measured by a specially devised ergometer, consisting of a stationary bicycle, which was belted to a small dynamo. The electric current generated passed through an incandescent lamp inside the chamber, where its energy was transformed into heat. The strength of current and voltage was determined by instruments outside the calorimeter. The heat equivalent of the muscular work done was thus added to and measured with the heat given off from the body. The duration of the work and the amount of the electric current generated gave data for the computation of the amount of work performed."

The special devices for regulating the temperature of the walls of the calorimeter, for regulating the temperature of incoming and outgoing currents of air, and for measuring the volume and temperature of the current of water which passes through the absorbers in the respiration chamber are described in detail, as are also the methods of conducting experiments with men.

The test experiments are discussed at length.

"In the electrical tests the measurements of heat generated and found were practically identical, the differences between the theoretical and actual results averaging about 0.1 per cent—that is, about 1 part in 1,000. In the alcohol tests the average amounts found by actual experiment were: For carbon, 99.9 per cent; hydrogen, 100.6 per cent; and heat, 99.9 per cent, respectively, of the theoretical amounts.

"The determinations of carbon dioxid and water made by burning large quantities of alcohol in the respiration chamber agree reasonably well with each other and with the theoretical amounts. The variations, indeed, are not greater than are found in ordinary laboratory experience when alcohol is burned in the combustion furnace by the usual methods of organic analysis.

"The agreement between the results given by the respiration calorimeter and the bomb calorimeter for the heat of combustion of alcohol . . . is also very satisfactory when the great difference in the circumstances of the experiments is taken into consideration."

In one of the experiments with men the subject performed as little work as possible; in the other a considerable amount of work was performed. Each experiment lasted 4 days. The average daily income and outgo of nitrogen and carbon and the calculated gain or loss of protein and fat are shown in the following table:

Average daily income and outgo of nitrogen and carbon in rest and work experiments, with the estimated gain or loss of protein and of fat.

Experiment.	Nitrogen.				Carbon.					Calculated gain or loss.	
	In food.	In feces.	In urine.	Gain (+) or loss (—).	In food.	In feces.	In urine.	In respiratory products.	Gain (+) or loss (—).	Of protein.	Of fat.
	Gms.	*Gms.*	*Gms.*	*Gms.*	*Gms.*	*Gms.*	*Gms.*	*Gms.*	*Gms.*	*Gms.*	*Gms.*
Rest (No. 9)	19.1	1.2	18.4	—0.6	261.5	13.3	12.6	223.6	+12.0	—3.6	+18.2
Work (No. 6)	19.1	1.5	16.5	+1.1	336.7	12.4	12.5	345.2	—33.3	+6.9	—48.3

The daily income and outgo of protein and energy in the 2 experiments is shown in the following table:

Comparison of daily income and outgo of protein and of energy in rest and work experiments.

Experiment.	Protein.		Energy.			
	Of food.	Actually oxidized.	Of food.	Of material actually oxidized.	Measured.	Difference.
	Gms.	*Gms.*	*Cals.*	*Cals.*	*Cals.*	*Per cent.*
Rest (No. 9)	119.4	115.0	2,275	2,354	2,310	+1.5
Work (No. 6)	119.4	103.1	3,830	3,864	3,726	—2.7

The experiments and the sources of error involved in them are discussed at length, as well as the bearing of this work upon the problem of the conservation of energy in the animal body.

"We would perhaps be unwarranted in assuming that the experiments thus far made completely demonstrate the application of the law of the conservation of energy in the human organism. They do, however, seem to us to be reasonably near to such demonstration, especially when we take into account the possible sources of error—chemical, physical, and physiological—which have been discussed above.

"It is certainly safe to assume that the principle followed in the experiments is correct, and that the apparatus and methods are accurate to the degree required for the experimental study of a large variety of the fundamental problems of biological chemistry and physics. Among these are the metabolism of energy and the production of heat by the body in the performance of its ordinary functions, as circulation, respiration, and digestion; the relations of muscular and mental work to the metabolism of matter and energy; the demands of the body for nutriment under different conditions of work and rest; the duties performed by the different nutrients of food in supplying the needs of the body; and finally, the nutritive values of food materials and the amount and proportions best adapted to the needs of people of different classes, with different occupations, and in different conditions of life. That such inquiries may be valuable for the study of food and nutrition in disease is equally apparent. Of course they are fundamentally necessary for a more thorough understanding of the economy of feeding domestic animals."

The physiological effect of creatin and creatinin and their value as nutrients, J. W. MALLET (*U. S. Dept. Agr., Office of Experiment Stations Bul. 66, pp. 24*).—A number of experiments in which the author was the subject are reported on the physiological effect of creatin and creatinin, the principal nitrogenous materials in meat extracts. In addition, methods of estimating creatin and creatinin were studied. The principal conclusions follow:

"By far the larger part of the flesh bases ingested, if not absolutely the whole, does not undergo metabolism with the production of urea or anything else, but on the contrary is eliminated by way of the kidneys. In the case of creatinin it is excreted unchanged, while creatin is changed wholly or very largely into creatinin. . . .

"The fact of the quantitative recovery of creatin and creatinin from the urine evidently accords fully with the generally accepted belief that these substances can not serve to build up proteids, and therefore are not to be classed among tissue-forming food materials.

"On the whole, this investigation is unfavorable to the idea of the creatin of living muscle being the main antecedent of urea in nitrogenous metabolism. . . .

"However this may be, and admitting that it is still an unsolved problem what nitrogenous substance or substances may properly be regarded as intermediate between muscle proteids and urea, it may fairly be regarded as established for nutrition investigations that the so-called flesh bases, creatin and creatinin, occurring in food may be entirely disregarded as sources of energy, being excreted practically without having undergone change. . . .

"In the discussion of the results of analyses of meat and forms of food prepared from it, such as soups and the like, it is evidently wrong and misleading to confound together, under the head of protein or proteid materials, the proteids proper, capable of building up the nitrogenous tissues of the living body and of furnishing muscular energy and heat by oxidation, and these so-called flesh bases, which, taken in along with food, are not available for either of these important purposes. This error is the more serious that creatin and creatinin, containing so large a percentage of nitrogen as they do, appear to represent and are counted as representing much more than their own weight of nutrient material, whereas they should be excluded altogether in food analyses from the nutrient material really present."

Food consumption under conditions of abnormal work, A. P. BRYANT (*Dietet. and Hyg. Gaz., 15 (1899), No. 7, pp. 393–397*).—From records of the kinds and amounts of food consumed by a professional bicycle rider during a six-day race, the author computes the amount of nutrients in the daily diet and its fuel value. These were protein 262 gm., fat 192 gm., carbohydrates 791 gm., and fuel value 6,100 calories. The amount of muscular work performed was also calculated.

"In the dietary here described, if the weights of food consumed are correctly reported and the food materials were of average composition, the protein used was over 2½ times the amount found in the average food consumption of a considerable number of families of working people, and the energy nearly twice as great. That in this case the diet was not greatly at variance with the needs of the body is indicated by the fact that there was but little change in the body weight during the six days."

The nutritive value of margarin compared with butter, E. BERTARELLI (*Riv. Ig. e San. Pubb., 9 (1898), Nos. 14, pp. 538–545; 15, pp. 570–579*).—Three experiments with healthy men are reported in which the value of margarin and butter was tested when consumed as part of a simple mixed diet. In one experiment the value of a mixture of olive oil and colza oil, which is commonly used in Italy in the neighborhood of Turin, was also tested. The author himself was the subject of one of the tests. He was 24 years old. The subjects of the other tests were 2 laboratory servants; one 27 years old, the other 32 years old. The coefficients of digestibility and the balance of income and outgo of nitrogen in the different experiments were as follows:

Digestion experiments with margarin, butter, and oil.

	Time.	Coefficients of digestibility.			Nitrogen.			
		Protein.	Fat.	Carbohydrates.	In food.	In urine.	In feces.	Gain.
	Days.	*Per cent.*	*Per cent.*	*Per cent.*	*Gms.*	*Gms.*	*Gms.*	*Gms.*
Laboratory servant, P. G.: 500 gm. white bread, 270 gm. veal, 70 gm. butter, 250–300 cc. wine	5	81.75	92.67	97.25	15.7	9.6	2.6	3.5
Laboratory servant, P. G.: 500 gm. white bread, 250 gm. veal, 70 gm. margarin, 250–300 cc. wine	5	79.50	93.90	97.07	15.7	10.3	3.2	2.2
Author: 450 gm. white bread, 250 gm. meat 70 gm. butter.	6	81.85	94.25	97.35	13.5	10.1	2.5	.9
Author: 450 gm. white bread, 250 gm. meat, 70 gm. margarin	6	77.80	93.73	96.70	13.5	9.6	3.1	.8
Laboratory servant, F. D.: 824 gm. white bread, 250 gm. meat, 61.6 gm. butter	5	85.32	95.80	97.38	16.5	13.2	2.9	.4
Laboratory servant, F. D.: 859 gm. white bread, 250 gm. meat, 61.6 gm. margarin	5	82.92	95.33	97.24	16.9	12.5	3.4	1.0
Laboratory servant, F. D.: 910 gm. white bread, 250 gm. meat, 61.6 gm. olive and colza oils	5	83.27	95.82	97.56	17.5	13.4	3.5	.6

The principal conclusions follow: When properly prepared margarin differs but little from natural butter in chemical and physical properties. On an average 93.5 to 96 per cent of fat was assimilated when margarin was consumed and 94 to 96 per cent when butter formed part of the diet. The moderate use of margarin did not cause any disturbance of the digestive tract.

Uses of the cassava crop, H. E. STOCKBRIDGE (*Florida Sta. Bul. 49, pp. 20–45, pls. 8*).—The author discusses the value of cassava as a feeding stuff and reports experiments with pigs and cattle. The fact is recognized that cassava is a food especially rich in carbohydrates and that it should be supplemented with nitrogenous material. The composition of a number of Florida feeding stuffs suitable for this purpose is quoted, among them being beggar-weed hay, crab grass hay, crowfoot hay, Spanish moss, pindars, sand-spur hay, velvet beans, and wire-grass hay. Suitable combinations of cassava with other feeding stuffs for horses, steers, cows, and pigs are suggested. The uses of cassava as a food for man are discussed and a number of receipts for preparing it are given. Its value for the manufacture of starch and glucose is pointed out. "As a raw material for the manufacture of starch, 6 tons of cassava produces 2,400 lbs. of commercial starch, as against 1,200 lbs. obtainable from 40 bu. of corn." According to analyses based on samples grown on several different plats, cassava contains 5.17 per cent water and 94.83 dry matter. The dry matter has the following percentage composition (food and fertilizer constituents): Protein, 2.54; fat, 0.55; resins, alkaloids, etc. (ether extract), 0.34; amids and sugars (alcohol extract), 16.96; crude fiber, 5.06; starch, 72.33; ash, 2.21; potash, 0.90, and phosphoric acid, 0.24. The fertilizing value of a number of by-products from cassava starch industry was found to be as follows:

Fertilizing value of by-products in the manufacture of starch from cassava.

	Water.	Volatile matter.	Nitrogen	Phosphoric acid	Potash.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Wash water	99.64	0.30	....	0.03	0.05
Fine cassava pulp	93 23	6 66	0.32	.38	.16
Coarse cassava pulp	89.14	10.73	.45	.06	.06
Cassava-bark residue	79 60	18.19	.75	.12	1.43

Experiments with pigs (pp. 23–28).—A test to compare cassava with corn, chufas, pindars, and goobers was made with 12 grade Duroc-Jersey pigs divided into 4 lots of 3 each. It began January 14, 1896, and covered 75 days. The average gain per pig was as follows: On cassava, 53 lbs.; corn, 59 lbs.; chufas, 21 lbs.; pindars, 16 lbs.; and goobers, 19 lbs. The cost of food per pound of gain was 1.04 cts. on cassava (at $6 per ton) and 3.06 cts. on corn. With pigs at 3 cts. per pound, there was a profit of 1.07 cts. per pound of gain on the cassava, and a loss of 0.35 ct. on the corn. Considering these data and the cheapness of growing cassava, the author concludes that "cassava properly used and fed must certainly be a very much more profitable crop than any other crop which can be converted into hogs and hog products."

Experiments in fattening beef on cassava (pp. 28–31).—A test of the value of cassava for fattening cattle was made with 2 animals, although the results for only 1 are reported. This was a "common Florida cow of the larger class." She was very thin at the beginning of the test and had received no food for some months except what she picked up in the woods. The test began February 19, 1899, and continued 75 days. The cow was fed all the cassava she would consume, which averaged 15 lbs. per day, and 2 lbs. of cotton-seed meal. To meet Florida conditions, she was kept in a hummock pasture, this being supplemented by an occasional feeding of pea vines, velvet beans, or crab-grass hay. At the beginning of the test the cow weighed 450 lbs. The live weight at the close of the test was 726 and the dressed weight 502 lbs. The cost of the food was estimated at $2.62, and the profit at $8.42. "Cassava proves itself a most superior beef-fattening food. The cost of live-weight beef produced by feeding cassava is 1.1 cts. per pound, and in 75 days a profit of 59.10 per cent was made by fattening beef upon cassava."

Alfalfa—feeding notes, H. M. Cottrell (*Kansas Sta. Bul. 85, pp. 14–16*).—In a test previously reported (E. S. R., 11, p. 182), pigs fed dry

Kafir corn and alfalfa hay were compared with lots fed whole Kafir corn, dry Kafir-corn meal, and wet Kafir-corn meal, respectively. In the present article the author discusses the profits from feeding the alfalfa hay.

"Valuing the alfalfa hay at $3 per ton, the average price on Kansas farms, and fat hogs at 3 cts. per pound live weight, the Kafir corn fed alone brought 22.4 cts. per bushel, while the Kafir corn fed with alfalfa hay brought 31.4 cts. per bushel after deducting the cost of the hay fed with it. . . . In a former experiment (E. S. R., 11, p. 182), pigs were pastured through the summer on alfalfa with a light feeding of corn. After deducting the probable gain from the corn, the gain per acre from the alfalfa pasture was 776 lbs. of pork. These facts indicate that to produce pork most cheaply the Kansas farmer must have alfalfa pasture in summer and alfalfa hay in winter."

Pasturing sheep on alfalfa, W. W. COOKE (*Colorado Sta. Bul. 52, pp. 1–23*).—A test of the value of alfalfa pasturage for sheep is reported, and the experience of a number of sheep raisers in the Arkansas Valley is quoted. In the test at the station 11 cross-bred Shropshire-Merino sheep were bred to a Shropshire ram in the fall of 1897. They were fed throughout the winter on alfalfa hay, with a little silage during a part of the time. Immediately after the lambs (11 in number) were dropped grain was added to the ration, and both ewes and lambs were turned out on an alfalfa pasture April 20. The test closed September 6. One of the ewes and one of the lambs died from bloat. Late in April the 10 remaining ewes were sheared, yielding 54 lbs. of wool. The ewes weighed on an average 90 lbs. each at the beginning of the test and 103 at the close. The lambs weighed 94 lbs. The ewes were sold for $3.50 per head and the lambs were valued at $4 per head. It is calculated that the net returns from the test were $23.20. "It should be remembered that these are the financial results, notwithstanding the 9 per cent loss from bloat on both ewes and lambs."

From the experience of sheep raisers in the Arkansas Valley the following general deductions are drawn regarding the value of alfalfa pasturage:

"The average of the statements from the various individuals seems to be about 10 ewes and their lambs to 1 acre of good alfalfa pasture, running on the land from the middle of April until the first of October. This would require very good alfalfa, and it is probable that 8 ewes to the acre would be nearer average conditions. The ewes would feed on the stubble fields practically without cost during October and November, leaving 4½ months that they would have to be hay fed.

"A full-grown ewe will eat 5 lbs. of hay per day, or 2⅘ tons of hay to run the 8 ewes through the winter. If we estimate an acre to produce 4 tons of alfalfa, then it would require ⅘ of an acre to supply hay for the winter and 1 acre to pasture them during the summer. . . . For the last 4 years lambs have averaged being worth 4 cts. a pound, live weight, on the farm the first of October. It is fair to presume that a person who was planning for pasturing alfalfa would have the lambs dropped in March; and they ought, then, to weigh 70 lbs. the first of October and be worth $2.80 each. The ewes would need to be fed grain for 60 days, 1 lb. per day, costing in all 40 cts. for each ewe. The ewes should shear 7 lbs. of wool each, worth at least 10 cts. per pound. . . .

> "[On the basis of these suppositions] $24.80 represents the return from the land that will produce 7 tons of alfalfa, or about $3.50 per ton for cutting and feeding about half the alfalfa and letting the sheep harvest the other half. Out of this return would need to be deducted the interest on the investment and any losses by bloat that may occur.
>
> "Whether or not any greater return for the alfalfa can be obtained in any other way, each farmer will need to answer for himself. It is believed that the items of income as given above are conservative estimates, and that profits much larger than this would often be obtained."

The dangers from pasturing sheep on alfalfa are mentioned, and the precautions to be observed are enumerated.

Raising early lambs, W. W. COOKE (*Colorado Sta. Bul. 52, pp. 24–32*).—To determine whether early lambs may be profitably raised in Colorado, tests extending over 3 years (1895–1898) were made. Each year 25 Shropshire-Merino and 25 Horned Dorset-Merino ewes were used. Fifteen of the Shropshire ewes were bred to Shropshire bucks and 10 to Dorset bucks; 15 of the Dorset ewes were bred to Dorset bucks and the remainder to Shropshire bucks. In the 3 years 61 Shropshire lambs, averaging 54 lbs. live weight and 26 lbs. dressed when 84 days old, were sold at an average price of $3.64 per head. In the same time a total of 74 Horned Dorset lambs, averaging 55 lbs. live weight and 25 lbs. dressed when 86 days old, were sold for an average of $3.57 per head.

> "The financial results are in favor of the Horned Dorsets. The first year they grew the faster, but in both the other years the Shropshires made the most weight and sold for the most per head. But the Dorsets produced so many more lambs as to more than overbalance their slower growth. On the whole the Dorsets brought in $40 more than the Shropshires, or about $\frac{1}{6}$ of the total income. This difference is due entirely to the larger number of lambs reared by the Dorsets. Their record is practically 100 per cent, since 74 lambs were sold from 25 ewes in 3 years."

In the above experiments it was calculated that the average yearly income from lambs for the 50 ewes was $162.93. To this should be added 70 cts. per head for wool. This makes the total yearly income from 1 ewe $3.96. At the close of the experiments the ewes were sold for a little more than they cost. In the author's opinion these returns compare very favorably with those which can be obtained from sheep pastured on the range. The data on which these calculations are based are discussed in detail. The experience of a number of individuals on raising early lambs in the Arkansas Valley is quoted.

The chemical composition of American food materials, W. O. ATWATER and A. P. BRYANT (*U. S. Dept. Agr., Office of Experiment Stations Bul. 28 (rev. ed.), pp. 87, figs. 4*).—In addition to historical statements regarding early American food analyses and a discussion of the principal constituents of food and methods of cutting carcasses of cattle, calves, sheep, and pigs, the bulletin contains the maximum, minimum, and average composition of the more important American food materials. These include meats of different kinds and cuts, fish, shellfish, eggs and dairy products, flour and cereal products, bread, vegetables, fresh and canned fruits, nuts, cakes, pastry, etc. The bulletin is a compilation based on over 4,000 individual analyses gathered from widely scattered sources.

Margarin products from the standpoint of hygiene and nutrition, A. Jolles (*Oesterr. Chem. Ztg., 2 (1899), Nos. 3, pp. 70–72; 4, pp. 105, 106; 6, pp. 157, 158; 8, pp. 213–216*).—This is an address reviewing the status of the subject. With reference to the digestibility and relative nutritive value of margarin, the author concludes that the matter is by no means settled. He reports a long experiment made by himself with a dog, which showed pure margarin to be equal in digestibility and nutritive value to pure natural butter. Stress is laid upon the fact that in such experiments pure material must be employed and the periods of observation at least 8 days.

Extensive investigations are cited as showing that the germ content of margarin is less than that of pure butter.

Paraffin as an adulterant of oleomargarine, J. F. Geisler (*Jour. Amer. Chem. Soc., 21 (1899), No. 7, pp. 605–608, pls. 2*).—The author mentions finding paraffin in 5 different samples collected in New York and Brooklyn, the amount of paraffin ranging from 5 to 11.76 per cent. The paraffin was extracted and exhibited as proof of the adulteration.

"It is pertinent to say that the object of the use of paraffin in oleomargarine is not to cheapen the article, but to make a more homogeneous fat mixture by preventing the separation of the fats and oils, and also affect the general consistency and appearance of the mass and its behavior under the trier in sampling. One of these samples was with difficulty distinguished from butter by physical tests."

The author discusses the effect of consuming paraffin, concluding that "at the present time there are no data to warrant anyone in saying that the use of paraffin, as above, is harmless in its effects upon the system."

Wheat for alimentary pastes in France, J. C. Covert (*U. S. Consular Rpts., 1899, No. 226, pp. 468–470*).—According to the author there is always a demand in France for wheats rich in gluten. These are used for the manufacture of alimentary pastes such as macaroni, spaghetti, etc., and for mixing with other wheat for use in bread making. The desirability of giving attention to growing such wheats in the United States is insisted upon.

Standard cookery book, N. Dubois and E. Bernard (*La cuisine classique. Paris: E. Dentu, 1897, ed. 17, vol. 1, pp. LXIV + 431, pls. 33; vol. 2, pp. 525, pls. 68*).—This is a very extended treatise on the subject of cookery, including methods of preparing and serving different foods.

The value of alcohol as a food, R. O. Neumann (*Arch. Hyg., 36 (1899), No. 1, pp. 1–44*).—A number of experiments are reported in which the author was the subject. The balance of income and outgo of nitrogen was determined. The author concludes that alcohol is a food; that is, it can replace fat and protect protein. The fact that alcohol has toxic properties is also insisted upon. The article contains an extended bibliography.

The digestibility of margarin, R. Kayser (*Ztschr. Öffentl. Chem., 5 (1899), pp. 101–103; abs. in Ztschr. Untersuch. Nahr. u. Genussmtl., 2 (1899), No. 9, p. 725*).—Summary of various investigations.

Handbook of dietetic treatment and dietetics, E. von Leyden (*Handbuch der Ernährungstherapie und Diätetik. Leipsic: G. Thieme, 1897–98, vol. 1, pp. X + 622; vol. 2, pp. VI + 825*).—These volumes contain chapters on nutrition in health and disease by a considerable number of specialists.

Practical dietetics with special reference to diet in disease, W. G. Thompson (*New York: D. Appleton & Co., 1896, pp. XXII + 802*).—In addition to a large amount of material on the diet suited to persons suffering with different diseases, the volume contains much matter on the composition, character, and uses of different foods and beverages; cooking and preservation of food, digestibility, average rations, and prison and other special dietaries.

Report of the examination of foods and feeding stuffs, Pfeiffer (*Ber. Thätigkeit Landw. Vers. Sta. Univ. Jena, 1898, pp. 5–8*).—The examination of butter and of a number of feeding stuffs, in accordance with the regulations controlling their sale, is briefly reported.

Concentrated feeding stuffs, J. L. HILLS, C. H. JONES, and B. O. WHITE (*Vermont Sta. Rpt. 1898, pp. 172–176*).—Analyses are reported of cotton-seed meal, gluten meals and feeds, Cleveland flax meal and linseed meal, corn bran, wheat bran and middlings, ground corn and oats, and a number of mixed feeds. The need of a law regulating the inspection and sale of feeding stuffs in Vermont is pointed out.

Division of animal physiology, KÜNNEMANN (*Ber. Thätigkeit Landw. Vers. Sta. Univ. Jena, 1898, pp. 23, 24*).—A number of foods and feeding stuffs were examined with a view to the detection of harmful constituents.

The food value of fresh and ensiled maize, H. WIBBENS (*Orgaan Ver. Oudleer. Rijks. Landbouwschool, 11* (*1899*), *No. 131, p. 100*).—Analyses are reported of fresh and ensiled maize.

The nutritive value of maize and maize forage, R. DUMONT (*Prog. Agr. et Vit.* (*Éd. L'Est*), *20* (*1899*), *No. 21, pp. 637–640*).—A general article.

The value of maize by-products as a feeding stuff, C. MONNOT (*Jour. Agricole* [*Paris*], *10* (*1899*), *No. 113, pp. 151–155*).—The value as a feeding stuff of the residue from maize used for the manufacture of glucose, beer, or starch is insisted upon and a number of feeding experiments with cattle briefly reported.

A digestion experiment with alfalfa hay (*Kansas Sta. Press Bul. 41, folio*).—As determined by a digestion experiment with a steer, hay made from alfalfa cut when in full bloom had the following coefficients of digestibility: Total digestible nutrients, 55.29; protein, 10.43 (albuminoids, 7.86; amids, 2.57); fat, 0.69; crude fiber, 15.99; and carbohydrates, 28.18 per cent.

The nutritive value of the Calabriaan citrus fruit pomace, F. GABBRIELLI (*Staz. Sper. Agr. Ital., 32* (*1899*), *No. 2, pp. 204–208*).—An analysis of pomace of citrus fruits is reported and its feeding value discussed.

Investigations on the metabolism of horses at work and resting, N. ZUNTZ and O. HAGEMANN (*Untersuchungen über den Stoffwechsel des Pferdes bei Ruhe und Arbeit. Berlin: Paul Parey, 1899, pp. X + 440, pls. 7, fig. 1*) —This is the publication in book form of an article previously noted (E. S. R., 11, p. 72).

Contribution to the subject of metabolism with insufficient diet, F. N. SCHULTZ (*Arch. Physiol.* [*Pflüger*], *76* (*1899*), *No. 7–8, pp. 379–410, fig. 1*).—A considerable number of experiments with rabbits and dogs are reported. These are discussed in detail. The possibility of removing fat from the animal body by partial fasting is also discussed at length, as well as the possibility of estimating the amount of fat in the body by determining the amount in a control animal. Analysis showed that flesh which was apparently free from fat still contained appreciable amounts which consisted quite largely of cholesterin.

Horses, cattle, and sheep of Hungary (*Képek Magyararszága'llattenyésztéséből. Budapest, pp. 16 + pls. 100*).—This work, which is published by authority of the Minister of Agriculture, consists of 100 plates of the animals exhibited at the Hungarian Millennial Celebration in 1896 and descriptive text in Hungarian, German, French, and English.

Cattle-feeding experiments, A. P. AITKEN (*Ann. Rpt. Distrib. Grants Agr., Education, and Research* [*Great Britain*], *1897–98, pp. 142–150*).—Abstracted from another publication (E. S. R., 10, p. 981).

The modern sheep (*Kansas State Bd. Agr. Quart. Rpt. 1899, Mar. 31, pp. 1–156, pl. 1, figs. 33*).—This volume contains many articles by different authors on breeds of sheep, breeding, fattening, and general care of sheep, and the value of different feeding stuffs, and on sheep diseases. A number of experiments made by the different experiment stations with sheep are quoted in considerable detail.

Raising sheep for mutton, C. F. CURTISS (*U. S. Dept. Agr., Farmers' Bul. 96, pp. 48, figs. 18*).—The author discusses the profitable production of sheep for wool and mutton, quoting extensively from the work of the stations, especially that of the Iowa Station.

Hog raising in the South, S. M. TRACY (*U. S. Dept. Agr., Farmers' Bul. 100, pp. 40*).—A popular bulletin describing the breeds and breeding of pigs, their diseases, and insect enemies, with special reference to conditions in the South. The author concludes that the obstacles to successful pig raising in the South can be overcome and that this industry may be made very profitable.

DAIRY FARMING—DAIRYING.

Feeding tests and their methods, J. L. HILLS (*Vermont Sta. Rpt. 1898, pp. 310–346, 370–400*).—Experiments on the proper length of feeding periods, the relative feeding value of different rations, and the experimental error in feeding tests were made in continuation of the previous year's work (E. S. R., 9, p. 877). Thirty-two cows were used in the tests, which lasted in all 25 weeks. In addition to hay and silage the following mixed feeds were employed: (1) Cotton-seed meal 3, linseed meal 3, corn meal 4, and wheat bran 6 parts; (2) Atlas gluten meal 8, corn meal 4, wheat bran 6 parts; (3) cotton-seed meal 2½, linseed meal 2½, corn meal 5, wheat bran 6 parts; (4) Atlas gluten meal 10, corn meal 3, wheat bran 5 parts; and (5) corn meal 4, wheat bran 8 parts.

Full data for the experiments, including weights of cows, barn temperatures, analyses and digestible ingredients of the fodders and feeds, records of the individual cows and the like, are tabulated. The details of the investigation and the results obtained are summarized by the author as follows:

"*The proper length of feeding periods.*—Four different grain rations were fed with hay and silage as roughages. The rations were so planned that a 'medium' and 'wide' ration were used with one lot of 8 cows, and two 'medium' rations with a second lot of 8 cows. Nutritive ratios averaged 1:6.1 to 1:9.8 and 1:6.4 to 1:6.9. The tests were thus of rations with nutritive ratios widely apart and with nutritive ratios closely alike. In these tests, periods 3 weeks long were as accurate measures of the character and extent of variations as were those lasting 4, 5, or 6 weeks, when the rations fed were widely apart in their nutritive ratios; but the effect upon both quantity and quality of varying rations which are closely alike in their nutritive ratios was somewhat magnified when they were fed for but 3 or 4 weeks. Judgment, experience, and individual circumstances need to be called into play in the choice of period length. The present and the former investigation have not settled the question absolutely, but may prove of use in the formation of judgment. The writer's present opinion is that with a sufficient number of cows at hand and 25 weeks before the opening of the pasture season, the 5-week period (12 days preliminary, 23 days experimental) is to be preferred over those of longer or shorter duration. It enables three comparisons to each cow, and apparently the results need no discount because of possible temporary effects. If suitable animals are few, or time is short, the 4-week period (10 days preliminary, 18 days experimental) will give results sufficiently accurate for all practical purposes, but which may need some discounting as regards quality changes.

"*The relative feeding value of rations of nearly equal balance.*—Different rations of nearly equal balance were fed in two experiments to 11 cows. Nutritive ratios ran from 1: 6.6 to 1: 6.3 and from 1: 6.1 to 1: 6.3.

"A unit of dry matter in the Atlas ration made 6 per cent more product than did a unit of dry matter in the cotton-seed-linseed ration, a reverse of last year's result. The trend in individual cases, however, was generally uniform. A unit of dry matter in the corn-silage ration made 10 per cent more product than did one in the corn-sunflower-head ration. The quality of the milk remained unaltered throughout. The results showed slight differences in one case, and considerable differences in the other case of feeding rations of equal balance. The present status of the matter seems indeterminate and further experiment is needed.

"*The relative feeding values of medium and of wide rations.*—Hay, silage, mixed feed Nos. 1 and 5 were fed to 11 cows. Nutritive ratios averaged 1:6.1 and 1: 10.0. From 6 to 11 per cent increase in production followed the substitution of the cotton-seed-linseed ration in place of the corn-and-bran ration. The quality of the milk remained unchanged.

"*The relative feeding values of medium and of wide rations, the latter fed in scant amount.*—Hay, silage, mixed feeds No. 1 and 5 were fed to 4 cows. Eight pounds of No. 1 and only 3 lbs. of No. 5 were fed. Nutritive ratios averaged 1 : 5.9 and 1 : 11.8. Production paralleled feeding. Lessening or increasing the dry matter eaten one-fourth respectively lowered or bettered production one-fourth. The milk was slightly poorer on the 'wide-scant' ration, but since the solids-not-fat as well as the fat were lowered no 'disproportionate' change was noted.

"*Experimental error.*—Uniform rations were fed 4 cows for from 9 to 20 weeks, and quite uniform production resulted. A pound of dry matter made essentially the same amounts of milk, solids, and fat at one time as at another. It is probably unsafe, however, to lay stress on apparent differences in feeding values that do not exceed 5 per cent.

"*Practical conclusions.*—Assuming that two-thirds of the manurial ingredients reach the soil, and allowing 20 cts. per hundred for skim milk, the total and the daily net gains of one ration over another in butter, skim milk, and manure, expressed in dollars and cents, are as follows:

Relative superiority of different rations.

Ration.	Days of feeding one cow.	Net gain.	Daily net gain, one cow.
			Cts.
Cotton-seed-linseed ration *vs.* ration of equal parts corn and bran	402	$12.46	3.10
Atlas ration *vs.* cotton seed-linseed ration	474	14 22	3.00
Cotton-seed-linseed ration *vs.* ration of 2 parts corn 1 part bran	115	2.58	2.24
Cotton-seed-linseed ration *vs.* ration of 2 parts corn 1 part bran (the latter fed in scant quantities)	92	4.13	4.49

"The Atlas ration proved superior and furnished the cheapest protein, the cotton-seed-linseed ration ranking second. The gain in the last experiment was entirely in skim milk and manure. The scantily fed cows lost flesh.

"The addition of sunflower heads to corn silage injured it and lowered production."

Record of the station herd for 1896–97, J. L. Hills (*Vermont Sta. Rpt. 1898, pp. 355–365*).—The record of 29 cows from November 1, 1896, to October 31, 1897, is given and compared with previous records of the station herd. The record of 20 of the cows belonging to the herd for 3 years and of 27 for 2 years is summarized in the following table:

Average record of 20 cows for 3 years and 27 cows for 2 years.

	Yield of milk.	Fat content of milk.	Yield of butter.	Cost of food.	Cost of purchased grain.	Cost of food per lb. butter.	Proceeds of butter sales.
Average of 20 cows:	*Pounds.*	*Per cent.*	*Pounds.*			*Cents.*	
1894-95	5,864	4.94	338	$53.16	$19.92	17.6	$79.30
1895–96	5,927	5.01	347	43.54	14.75	13.5	79.77
1896–97	6,475	4.87	368	49.77	19.26	14.0	89.24
Average of 27 cows:							
1895–96	5,657	5.12	338	42.56	14.45	13.3	77.76
1896–97	6,012	5.04	354	48.66	18.98	13.8	85.80

"The herd, as a whole, made the most milk and butter per cow during 1896–97. The butter was made more cheaply during 1895-96. . . . The excess of proceeds per cow over total cost of food for the 3 years, respectively, is $26.34, $32.51, and $34.59. The more favorable result of the last year is entirely due to better selling prices. . . .

"As in past years the Ayrshires rank high in yield and in economy of production of milk, and relatively low in economy of production of butter."

Studies in milk secretion, H. H. WING and L. ANDERSON (*New York Cornell Sta. Bul. 169, pp. 519–552, pls. 4, dgms. 3*).—The records of the university herd from 1891 to 1898 are presented in tables and discussed. The herd consists of about 20 grade Jersey and Holstein cows, and has been developed from the ordinary stock of the neighborhood by a course of breeding and selection begun in 1875. The results of the studies are given in the authors' general summary and conclusions:

"A good grade herd can be bred up from a herd of ordinary cows by the use of first-class thoroughbred sires and a careful selection of the best heifers.

"By breeding in this way the university herd has increased in milk production from an average of 3,000 lbs. per cow in 1874 to an average of 7,575 lbs. in 1898.

"It pays to select heifers from the best cows as well as to use only well-bred bulls. Milk such heifers at least one year and then retain only those which give promise of being profitable producers.

"The greatest production for one lactation period was by Ruby in 64 weeks, 16,089.5 lbs. of milk and 531.32 lbs. of fat, equivalent to 625 lbs. of butter containing 85 per cent fat.

"The average production for 7 years was 7,330 lbs. of milk, 275 lbs. of fat, and 3.76 per cent fat. The average for each year varied from 6,875 lbs. of milk in 1892–93 and 266 lbs. of fat in 1895–96 to 7,575 lbs. of milk in 1897–98 and 292 lbs. of fat in 1893–94.

"The average gain in production of milk as the cows increased in age was 5 per cent from two to three year olds, 18 per cent from three to four year olds, and 15.3 per cent from four-year-olds to full aged cows.

"The average gain in production of butter fat was 5.5 per cent from two to three year olds, 17 per cent from three to four year olds, and 13.6 from four-year-olds to full aged cows.

"Beginning with the third week after calving and dividing the remainder of the lactation into periods of 4 weeks, and then considering the average daily yield of milk of all the cows for the first period as 100, there was a gradual decrease in milk flow to 55 during the eleventh period. Calculating the average percentage of fat in like manner, there was a decrease to 96 in the second period and then a gradual increase to 106 during the eleventh period.

"Speaking in other terms, there was an average decrease in yield of milk as lactation advanced of about 5 per cent from each period of 4 weeks to the next. In percentage of fat there was an average increase of about 0.5 per cent from month to month.

"As a rule, a cow will produce more butter during the first few weeks of a lactation period than at any equal subsequent time during the same lactation.

"The general effect of the change from barn to pasture was an increase in both milk flow and percentage of fat for the first 2 weeks, and for the next 3 weeks a slight decrease in milk and percentage of fat below the daily average for the last 3 weeks in the barn.

"During the year 1892 20 cows produced milk for 62½ cts. per hundredweight, and fat for about 16 cts. per pound for the food consumed.

"In general, the cows consuming the most food produced both milk and fat at the lowest rate."

The effect of fatigue upon the quantity and quality of milk, J. L. HILLS (*Vermont Sta. Rpt. 1898, pp. 367, 368*).—Ten cows were driven 10 miles and shipped 50 miles by rail. During the 24 hours in transit they were not milked. Tables show the yield and composition of the milk for each milking for the first, second, fifth, and sixth days after arrival, and the average for 2 days 3 weeks after arrival. Considerable individual variation was observed.

> "The quantity of milk was lowered as an immediate result, but normal flow seems to have been nearly restored by the end of the second day. The fat percentage dropped during the first day and was decidedly increased the second day, remaining a little high during the next few days, as compared with the flow of 3 weeks later. Solids-not-fat averaged about the same, except for the second milking."

The results are compared with those of a similar test with 25 cows previously reported (E. S. R., 8, p. 86).

> "The main results are identical in each case, save that the temporary lowering of quality observed in the present test did not occur in the former trial while enrichment did ensue. 'It seems safe to conclude as a result of the two tests that fatigue tends to lessen the milk flow temporarily, to affect variously its quality for the first one or two milkings, and to raise the quality for a while after the second milking."

The effect of food upon the quality of butter, J. L. Hills (*Vermont Sta. Rpt. 1898, pp. 347–350*).—The effect of various feeding stuffs upon the quality of butter and upon churnability as previously determined (E. S. R., 9, p. 884) was practically confirmed in a study made in connection with the experiments noted above. The rations used contained hay and silage with the following concentrated feeds: (1) Atlas gluten meal, corn meal, and wheat bran; (2) corn and bran; (3) cotton seed, linseed meal, corn, and bran; (4) bran and cotton-seed oil, and (5) bran.

Tables give the scoring and chemical analyses of the butter and the data for churning. Butter made from cows on ration 4 ranked lowest. The use of Atlas gluten meal appeared to decrease the exhaustiveness of the churning.

Preservation of milk samples, J. L. Hills (*Vermont Sta. Rpt. 1898, pp. 350–355*).—The author presents the results of an investigation made by D. Stuart, of the agricultural department of the university, on the comparative merits of various preservatives for milk samples. The experiments included tests of 57 chemicals, 29 of which it is stated had not hitherto been used for this purpose. The results obtained by other investigators on the use of 93 chemicals as antiseptics are also noted.

Of the 122 different chemicals mentioned the following only are considered useful for this purpose: Mercuric chlorid, a mixture of 10 parts mercuric chlorid and 50 parts borax, potassium chromate, potassium bichromate, sodium sulphite, sodium bisulphite, copper-ammonium sulphate, sodium salicylate, and formaldehyde.

The use of potassium chromate and bichromate is noted as causing the samples to churn easily and producing tenacious cream and black curd in warm weather and with the steam tester; sodium salicylate as not dissolving readily and being costly, bulky, and inconvenient to handle; and copper-ammonium sulphate as lessening the miscibility of the sample and giving it an unpleasant odor.

> "Mercuric chlorid is relatively costly, and virulently poisonous, a serious objection. The mixture of mercuric chlorid and borax seems efficient, and while less poisonous than the pure salt is still open to objection on this score. Sodium sulphite and bisulphite must be used in considerable quantity, and they do not prevent

a putrid smell. Formaldehyde (formalin) seems to have but a single fault, that it tends to harden the casein, thus making it somewhat more difficult to 'cut' the curd by the sulphuric acid. Greater thoroughness in mixing obviates this. . . . In the course of our experiments 0.13, 0.25, 0.50, 0.75, 1.25, 2.50, 3.75, 5.00, 8.75, and 12.50 per cents of formalin were added respectively to 10 jars of milk. These samples were tested periodically for a month, without diminution of the fat reading, which coincided (corrected for dilution when the preservative was used in large quantities) with the analysis of the fresh and untreated milk. The fat columns were clear in every case, regardless of the relatively large amounts of preservative used. . . . Used in amounts of 1 per cent or more it tends to increase the total solids from 0.20 to 0.50 per cent. This may be due to the polymerization of the aldehyde, to the conversion of the milk sugar into galactose, to both, or indeed to some other cause not understood. This effect is not observed when it is used in small quantities."

Brief notes are given on the composition of 9 commercial preparations for preserving milk tested at the station.

Bacteriology of milk, L. L. LEWIS (*Oklahoma Sta. Bul. 40, pp. 16, figs. 8*).—In connection with a popular discussion of the subject the author gives the results of a number of experiments in the preservation of milk by pasteurization and by the use of formalin. Determinations were made of the number of bacteria in the first, middle, and last milk drawn; in milk after standing 1, 2, 3, and 4 hours at 33° C., and in milk pasteurized for 15 minutes at 60° and for 15 minutes at 70° C. The time required for milk not pasteurized, and milk pasteurized for 15 minutes at 60° and for 15 minutes at 70° C. to develop sufficient acid to neutralize 1.5 cc. of deci-normal soda solution was 25, 30, and 46 hours, respectively. Pasteurization increased the keeping qualities of milk to which formalin had been added in the proportion of 1 to 30,000, but did not with formalin added in the proportion of 1 to 10,000. The morphology and growth upon various media of 4 bacilli isolated from pasteurized milk are reported in detail.

Killing the tubercle bacillus in milk, C. E. MARSHALL (*Michigan Sta. Bul. 173, pp. 311–321, fig. 1*).—The work of a number of investigators along this line is reviewed and experiments conducted at the station are reported.

In one series of 5 experiments sterilized milk was infected with tuberculous material from different cows and then pasteurized by heating to 68° C., holding at that temperature for 20 minutes, and cooling rapidly. In each experiment one guinea pig for control was inoculated intra-abdominally with 1 cc. of the infected milk before pasteurization, and a number of guinea pigs were similarly inoculated with 5 cc. of the pasteurized milk. All of the control animals died from tuberculosis within a few weeks, while none of the 13 animals inoculated with the pasteurized milk became tuberculous.

As a temperature of 68° C. for 20 minutes does not produce a cooked flavor in the milk and is shown by the experiments to kill the tubercle bacillus, the author argues that a lower temperature for pasteurization should not be adopted.

In 3 experiments milk was heated in a receptacle placed within a water bath in imitation of crude methods of pasteurization. The temperature of the water and milk during the process of heating is given. The results are considered as showing that any method of pasteurization controlled entirely by the temperature of the water is unreliable.

Several experiments were made in pasteurizing milk artificially infected with tuberculous material, at a temperature which would give the milk a cooked flavor. This was done by heating the water surrounding small bottles of the milk to the boiling temperature, removing the heat, and allowing the milk and water to stand for 5 or 30 minutes. Four guinea pigs inoculated with the unpasteurized milk developed general tuberculosis within a few weeks. The 12 inoculated with 5 times the quantity of pasteurized milk remained free from any trace of the disease.

An apparatus, devised at the station for family pasteurization of milk where the slightly cooked flavor and odor are not objectionable, is described and illustrated, and directions are given for using.

"This pasteurizing apparatus was suggested by Novy's laboratory pail sterilizer, and consists of a covered pail with a perforated bottom placed upon a water bath provided with a shoulder to receive it. There is a hole in the cover so as to provide for a continuous stream of steam. Inside the pail is a rack which holds the bottles in position. The water bath is shallow and flanges out from the shoulder. By this means a large heating surface is presented and the water is soon raised to the boiling point upon the application of heat."

The excretion of micro-organisms through the lacteal glands, K. BASCH and F. WELEMINSKY (*Arch. Hyg., 35 (1899), No. 3-4, pp. 205-226*).—The authors inoculated guinea pigs in various ways with cultures of anthrax, typhus, diphtheria, cholera, and *Bacillus bovis morbificans* to determine whether the germs of these diseases could be transmitted through the milk. There was no transmission of the anthrax, typhus, diphtheria, or cholera germs, the milk in each case being sterile.

The authors conclude that in general disease germs are not transmitted to the milk except such as produce hemorrhages or an abnormal condition of the glands. It is believed, however, that the question must be settled separately for each disease and for different kinds of animals.

Tubercle bacilli in butter, O. KORN (*Arch. Hyg., 36 (1899), No. 1, pp. 57-65*).—Twenty samples of butter, most of them produced by peasants near Freiburg, all unsalted, and some from sweet and some from ripened cream, were examined for tubercle bacilli. Three of the samples produced death from peritonitis in all of the guinea pigs in which they were inoculated. Of the remaining 17, 4 were found to contain virulent tubercle bacilli.

The author strongly recommends compulsory testing of all dairy herds, and the exercise of great care in the selection of laborers entirely free from tuberculosis for the care of the animals and the handling of the milk.

The relation of acid fermentation to butter flavor and aroma, C. H. ECKLES (*Iowa Sta. Bul. 40, pp. 53-64*).—This is a semipopular article on the above subject, including some original work and citing examples from experience. The author's conclusions are summed up as follows:

"Butter flavor is produced mostly by the bacterial fermentations which have taken place in the milk and cream. The kind of flavor produced depends upon the class of bacteria causing the fermentation. Cream ripened with common bacteria found in hay dust (*Bacillus subtilis*) gives a very undesirable flavor to butter.

"The general superiority of butter flavor in the summer season is mainly due to the difference in the fermentations that are in the milk.

"This difference is due to the greater number of bacteria of the acid class found in the milk during the summer season.

"The ripening of a good quality of natural cream is mostly a development of acid bacteria. When good-flavored cream is ready for churning, the number of bacteria per cubic centimeter varies from 280,000,000 to 3,000,000,000. Of this number the acid-producing bacteria constitute from 91 to 98 per cent. As the process of ripening advances, the relative percentage of acid bacteria greatly increases. As this proceeds, some species disappear; others are prevented from increasing in numbers.

"A good natural skim-milk starter is practically a pure culture of acid-producing bacteria.

"The flavor-producing power of four species of acid-producing bacteria was tried by using them to ripen pasteurized cream. Any one of these gave the butter the typical flavor and aroma produced in natural ripening.

"The most common milk-souring organism (*Bacterium lactarii*), all things considered, gives the most satisfactory results of any of the species tried as a culture for ripening cream.

"Practical experience and experimental evidence both indicate that the most important factors in cream ripening are the development of the typical acid fermentations and the elimination or suppression of other and injurious types of fermentations."

On the bacteriology of cheese, C. GORINI (*Bol. Not. Agr., 19 (1897), pp. 388-397; abs. in Centbl. Bakt. u. Par., 2. Abt., 5 (1899), No. 1, pp. 44-46*).—The author studied the effect of the conditions of growth in cheese on the physiological activity of seven different forms of bacteria, i. e., *B. lactis niger*, *B. lactis thermophilus*, and five different forms belonging to the group *subtilis*. He found that bacilli which were biologically very similar behaved differently in regard to milk fermentation, according to the temperature and the presence or absence of air. Bacilli which soured milk at a high temperature peptonized it at a lower temperature. The higher temperature favors the increase of bacilli, which attack the milk sugar and produce lactic acid, and this in turn checks the action of the bacteria, so that the casein remains intact. A proof of this is that when the milk is neutralized peptone formation takes place. The exclusion of air checks the peptonizing of the casein especially. When the vacuum was not complete, the milk was curdled, but no peptonizing action took place, although it progressed rapidly as soon as fresh air was admitted. It is claimed that the investigations show that bacteria may attack the milk sugar or the casein, depending upon the conditions under which they are placed.

Cream raising by dilution, J. L. HILLS (*Vermont Sta. Rpt. 1898, pp. 365, 366*).—One hundred and twenty trials were made with two sizes of the "Wheeler Gravity Cream Separator," using herd and stripper milk from Jersey and Ayrshire cows.

"These same milks were closely skimmed by the centrifugal separator, which, moreover, was able to extract some cream from the diluted skim milks. The 'gravity separator' left in the skim milk 13 per cent of the fat of the mixed milk, 40 per cent of the fat of the Ayrshire milk, and 17 per cent of the fat of the stripper milk. The centrifugal separator left between 1 and 2 per cent of the fat of these milks behind in the skim milk. The results speak for themselves and call for no further comment."

Notes are given on the Wheeler can and on similar tests made at the New York Cornell Station (E. S. R., 10, p. 591).

Concerning patents on gravity or dilution separators, H. H. WING (*New York Cornell Sta. Bul. 171, pp. 18, figs. 8*).—Conclusions from tests of several cans for cream raising by dilution are quoted from Bulletin 151 of the station (E. S. R., 10, p. 591), and descriptions, mainly in the form of extracts from the specifications and claims under which patents were granted, are given of the Aquatic, Thayer, Phillip, Rector, Wheeler, Hunt, Rosback, and Doty gravity cream separators or creaming cans. The author holds that the patents granted on these cans, in which the dilution of milk with water is recommended to facilitate the separation of the cream, cover unimportant details of construction and that "anyone desiring to use this process of doubtful utility is perfectly free to do so without let or hindrance from the holder of any patent right whatever."

Miscellaneous dairy notes, J. L. HILLS (*Vermont Sta. Rpt. 1898, pp. 368–370*).—Analyses are given of samples from 3 lots of Vermont creamery butter shipped to the English market.

Two patent churns were tested, in one of which the churning was accomplished by a narrow disk of wood whirling through the cream, and in the other by pumping air through the cream. Neither was considered as desirable as the ordinary concussion churn.

Analyses are given of the milk drawn from one cow on the seventh, fourth, third, second, and last day before calving, and the average analyses of the milk for the 6 weeks following. A lactometer reading of 51.5 on the seventh day previous to calving is thought to be the highest on record.

Thirty-four comparisons were made of the Babcock test and the Bartlett modification of the Babcock test (E. S. R., 9, p. 184). The results averaged 0.05 per cent less by the modified method. "The modification appears to have merit, but, as intimated by its originator, ought to be used only by those well skilled in the usual method of testing."

Cow ties and stalls (*Hoard's Dairyman, 30 (1899), No. 33, pp. 654, 655*).—Several are described and illustrated.

An experimental creamery building at Hoorn, K. H. M. VAN DER ZANDE (*Landbouw. Tijdschr., 1898, pp. 1–10*) —A plan for an elaborate experimental creamery building with a bacteriological laboratory.

Dangers in milk and means of combating them, R. GATTA (*Jour. Hyg., 24 (1899), No. 1185, p. 185*).

Dairy sanitation, C. M. DAY (*Jour. Comp. Med. and Vet. Arch., 20 (1899), No. 8, pp. 473–477*).—Advises approved sanitary methods so as to prevent the entrance of pathogenic bacteria into milk.

The milk supply of cities, H. W. CONN (*Pop. Sci. Mo., 55 (1899), No. 5, pp. 627–640*).—Recommends organized milk companies which can handle and pasteurize milk on a large scale.

Experiments with pasteurizing apparatus, F. FRIIS (*43. Ber. Kgl. Vet. Landbohojskoles Lab. Landokon Forsog. Copenhagen, 1899, pp. 152, ills.*).—An account of a number of tests with different kinds of pasteurizing apparatus.

Butter and margarin—composition, properties, manufacture, adulteration, preservation, marketing, and legislation (*Le beurre et la margarine (composition, propriétés, fabrication, alterations, conservations, commerce, legislation). Paris: Gauthier-Villars, 1899, pp. 163*).

How to make farm dairy cheese, T. L. HAECKER (*Hoard's Dairyman, 30 (1899), No. 35, p. 692*).– Detailed directions are given.

The manufacture of Roquefort cheese, N. ROUCHÈS (*La fabrication du fromage de Roquefort. Paris, 1899, pp. 67, pls. 14*).

Officials, associations, and educational institutions connected with the dairy interests of the United States for the year 1899 (*U. S. Dept. Agr., Bureau of Animal Industry Circ. 26, pp. 8*).—A list of each.

VETERINARY SCIENCE AND PRACTICE.

Contribution to the study of immunity; properties of mixtures of toxins with their antitoxins; constitution of toxins, J. DANYSZ (*Ann. Inst. Pasteur, 13 (1899), No. 7, pp. 581–595*).—The results of the experiments recorded in this paper may be summarized as follows: The particular manner of the action of toxins as well as properties of the mixtures of a toxin and its antitoxin is not due to differentiation of the toxin into different substances more or less toxic, but simply to the presence of phosphates in these mixtures in greater or less proportions, depending upon the greater or less attenuation of the toxins. A single active substance can produce different results in different animals under different conditions, according to the variable proportions of the phosphates and other salts contained in the mixtures. This accounts for the difference in susceptibility in different animals to the action of the same toxin.

Combating disease-producing germs, C. E. MARSHALL (*Michigan Sta. Bul. 172, pp. 293–310*).—The author gives a general discussion of the relationship of infectious diseases to unsanitary conditions and accumulations of filth.

Among chemical substances which are good disinfectants, the author mentions the following: Corrosive sublimate, carbolic acid, formalin, sulphur fumes, whitewash, chlorid of lime, salicylic acid, and boracic acid. Directions are given for preparing proper solutions, liquid or gaseous, of these various substances for use in disinfection.

A number of methods for disinfecting houses, stables, utensils, and clothes are given.

For disinfecting creameries, no substance is entirely reliable unless the woodwork has been previously cleaned from all oily filth. The creamery may then be disinfected by means of formalin gas. Barns and stables are usually too open to allow the use of any fumigating disinfectant, and the author recommends spraying the woodwork with a solution of corrosive sublimate. When yards and pastures become infected with a contagious disease, the main reliance must be placed upon the action of direct sunlight. Animal excreta may be disinfected by the use of chlorid of lime, slack lime, or carbolic acid.

Texas fever, L. L. LEWIS (*Oklahoma Sta. Bul. 39, pp. 28, figs. 5*).—The author gives a general account of the protozoan germ which causes the disease and of the appearance and habits of the cattle tick which carries the germ.

A number of cattle-dipping experiments were tried in the summer of 1898. Two hundred and forty cattle were dipped under the supervision of the experiment station. The vats and chutes are described and figured in detail. The vat used had a capacity of about 1,500 cattle a day and cost $210. The object of these experiments was to secure an oil which would effectively destroy the ticks and not irritate the skin of the cattle. The cattle were dipped in oil from 40 to 42 in. deep. The ticks were all killed. When the cattle were allowed to go into the vat upon an incline, the legs were exposed longer to the action of the oil and the ticks were more effectively destroyed than when the cattle were plunged suddenly into the vat. By the former arrangement it is not considered necessary to fill the vats with a solid mass of oil. The first cattle dipped were dropped through from a trap door 2 ft. above the surface of the oil They were allowed to drip 10 minutes after leaving the vat. Within 2 hours after the dipping a number of animals showed signs of irritation about the eyes, but this irritation was not serious if the cattle were kept quiet and prevented from becoming dusty. Oil was found to be more severe on the Jerseys and light-colored animals than on dark ones.

A test was made to determine the effect on the skin and eyes, and changes in temperature from oil which came from the National Oil Company of Cleveland, Ohio. The oil had a specific gravity of 0.854 and contained no sulphur. Sulphur was added to the extent of 0.75 per cent. Only very slight elevations of temperature took place, and the temperature soon fell to the normal. The irritating effects upon the skin and eyes were much less noticeable than in the case of dynamo oil. The animals which were used in this experiment were not infested with ticks, but experiments conducted in the laboratory led the author to believe that this oil is as effective as the dynamo oil in the destruction of ticks.

A detailed tabular record is given of the results of experiments in producing immunity by means of inoculation of the defibrinated blood of animals which had partially or entirely recovered from the disease.

The number of animals experimented with was small, but the results were favorable.

Foot rot (*Rpt. Agr. Expts. Cornwall, 1898, pp. 50-51*).—Two objects were had in mind in making experiments with regard to this disease: To devise a practical remedy, and to determine whether or not the disease is indigenous to native soils. For curing the disease the following remedy was applied: Two pounds of arsenic and 2 lbs. of common soda were boiled in 1 gal. of water for half an hour. Five gallons of water were added to this solution and the whole was then placed in a long trough so that the depth of the solution was about the same as the depth of the hoof. Loose portions of the hoof were scraped off and the sheep were then made to walk through this trough. The treatment was repeated once a fortnight until a cure was affected. Two or three such treatments were usually sufficient for a permanent cure.

In order to determine whether or not this disease is indigenous to the soil, a tract of land which had the reputation of being favorable to the foot rot was selected. Sheep free from foot rot were then placed upon this tract and kept there for about 2 months. No cases of the disease developed.

The gapeworm and the white intestinal worms of poultry, F. V. THEOBALD (*Jour. Bd. Agr. [London], 6 (1899), No. 2, pp. 157-165, fig. 1*).—In this paper the author discusses the amount of loss caused by the gapeworm. This worm has been found in the sparrow, starling, rook, hooded crow, linnet, martin, swift, magpie, green woodpecker, and earthworm, in addition to domestic poultry. The earthworm has been believed by some authors to be a necessary intermediate host for the gapeworm, but, as has already been shown and as the author again demonstrated by experiments, the eggs of the gapeworm when fed to healthy poultry develop readily into adult gapeworms. The earthworm is therefore to be considered as one means of carrying the worms, rather than a regular intermediate host. The symptoms of the disease and post-mortem appearances are described in some detail.

On the subject of treatment, the author recommends immediate isolation of all birds which are infected with gapeworms in order to prevent further spread of the disease by coughing up adult worms. For the treatment of fowls suffering from the disease the use of a fumigating box is advised. This box should be large enough to hold several birds at once. Through a small opening finely-divided chalk mixed with finely-ground camphor should be blown. The dust mixture should be in proportion of 1 oz. of chalk to half an ounce of camphor. The dust is then inhaled by the fowls, the camphor causes the gapeworms to loosen their hold, and the dust induces violent coughing of the fowls, which is usually sufficient to eject the worms.

Report on the progress of dermatology in the field of pathology in 1898, E. KROMAYER (*Centbl. Allg. Path. u. Path. Anat., 10 (1899), No. 16-17, pp. 617-638*).—A discussion of the literature of the subject with a bibliography of 360 titles.

On preventive inoculation, W. M. HAFFKINE (*Proc. Roy. Soc. [London], 65 (1899), No. 418, pp. 252–271*).—A discussion of various general problems connected with the interpretation of the meaning of artificial immunity.

The possibility of the development of the typhus bacilli upon cooked potatoes in the presence of coli bacillus and ordinary soil bacteria, E. PFUHL (*Centbl. Bakt. u. Par., 1. Abt., 26 (1899), No. 2–3, pp. 49–51*).—The author undertook these investigations during a typhus epidemic in order to determine whether typhus could be transmitted in cooked potatoes. Several experiments made with this purpose in view gave results which indicate that typhus bacilli live and multiply plentifully in the presence of coli bacillus and other bacteria such as are found in the ordinary soil of the garden.

Animal diseases, A. T. PETERS (*Nebraska Sta. Rpt. 1898, pp. XVII–XXV*).—The report gives a brief account of the author's work on the following diseases: Blackleg, calf cholera, cornstalk disease, ergotism, glanders, hog cholera, keratitis, rabies, Texas fever, and tuberculosis. Over 33,000 doses of blackleg vaccine were distributed in the State, the greater part of them being furnished by the Pasteur Vaccine Co., and Bureau of Animal Industry. Ergotism is said to have been unusually prevalent in the State during the past year.

Symptomatic anthrax of cattle transmitted to man, G. FALCONE (*Giorn. R. Soc. Accad. Naz. Vet. Ital., 48 (1899), No. 36, pp. 844–848*).—Man may become infected by eating the meat of animals suffering from this disease.

The morphology of actinomyces, H. BRUNS (*Centbl. Bakt. u. Par., 1. Abt., 26 (1899), No. 1, pp. 11–17*).—From a case of actinomycosis in man the author obtained the pathogenic germ and made numerous cultures upon different media. From these pure cultures inoculations were then carried out on rabbits, mice, and guinea pigs. In no case was the author able to produce actinomycosis in the experiment animals and concludes, therefore, that the actinomyces in question is a species distinct from the actinomyces of cattle.

Anthrax, A. BERGSTRAND (*Landtmannen, 10 (1899), Nos. 32, pp. 522, 523; 33, pp. 538–540*).—A discussion of the nature of the disease with various practical suggestions as to methods for preventing infection of herds and for stamping out the disease

The agglutination of anthrax bacillus by normal human blood, LAMBOTTE and MARÉCHAL (*Ann. Inst. Pasteur, 13 (1899), No. 8, pp. 637–641*).—The author carried on investigations by means of which he found that the serum of normal human blood has the power of agglutinating the anthrax bacillus. The agglutinating power is manifested even in a very dilute solution of the serum; for example, 1:350. The blood of 41 persons was used in these experiments.

Some reflections upon the anthrax epidemics of West Gothland, W. FLACK (*Landtmannen, 10 (1899), No. 31, pp. 493–495*).—A brief article describing the extent of the ravages from this disease and recommendations of means for preventing its spread.

Report on the work of the agricultural bacteriological laboratory of the Department of Agriculture for 1898 (*Selsk. Khoz i. Lyesor., 194 (1899), July, pp. 23–54*).—This report covers investigations on the following topics: The biology and relationship of a rat-destroying bacillus; the pathological anatomy of mouse and rat diseases; the influence upon the virulence of mouse destroying bacteria of various saprophytes grown on the same culture medium; determination of the absolute virulence of various mouse-destroying bacteria; a comparative study of methods of sterilizing milk; field experiments in the destruction of susliks; the action of various mouse-destroying bacteria upon domestic animals; and the distribution of cultures to correspondents of the laboratory.

Experimental tuberculosis in the ass and the effect of tuberculin, S. STOCKMAN (*Jour. Comp Path and Ther., 12 (1899), No. 2, pp. 125–137, fig. 1*).—The article contains an account of cases of tuberculosis in an ass, mule, and horse. The author concludes with regard to the tuberculin test that the small quantity of tuberculin

which is ordinarily employed for the detection of tuberculosis is not sufficient in itself to account for the fever reaction. It is suggested that the hypodermic injection of the tuberculin causes a hemorrhagic condition in that particular spot and that as a result of this hyperemic condition some of the tubercle bacilli are killed and the substance which causes fever is set free from these dead bacilli. The author has injected from 10 to 30 cc. of tuberculin into a healthy dog without producing any fever reaction.

Congenital tuberculosis in the calf, J. McFADYEAN (*Jour. Comp. Path. and Ther., 12 (1899), No. 2, pp. 156–162*).—Three cases are recorded and outlined in some detail. The author discusses also the distribution of the tuberculous lesions in these calves.

On the transmission of the tubercle bacillus through the placenta, ANCHE and CHAMBRELENT (*Arch. Med. Exper. et Anat. Path., Paris, 1. ser., 11 (1899), No. 4, pp. 521–545, pl. 1*).—The number of authentic cases of transmission of the tubercle bacillus by means of the placenta is very small. It has never been observed to take place before the fifth month of pregnancy. The tuberculous lesions are in such cases generalized and found in nearly all organs.

Some of the economic aspects of the prevention of tuberculosis in cattle, S. DELÉPINE (*Veterinarian, 72 (1899), No. 859, pp. 453–466*).—Discusses the necessity of fighting the disease and the cost of so doing, and adds statistics from experiments.

On the agglutination of the tubercle bacillus, MONGOUR and BUARD (*Compt. Rend. Soc. Biol., Paris, 11. ser., 1 (1899), No. 23, pp. 564, 565*).—The authors have observed that the agglutinating reaction takes place more rapidly and more clearly in a more resisting subject, and agglutination, therefore, appears to them to be a reaction of defense.

Action of microbes on the development of tubercle bacillus, F. RAMOND and P. RAVANT (*Arch. Med. Exper. et Anat. Path., Paris, 1. ser., 11 (1899), No. 4, pp. 494–497*).—The presence of other bacteria has in general the effect of stimulating the development of the tubercle bacillus.

Colic of horses, GRAF (*Ztschr. Veterinärk., 11 (1899), No. 7, pp. 342–356*).—Considers the following affections: Obstruction of the gullet and stomach, colic of the small and large intestines, cramp colic, and wind colic.

Vaccinations against contagious pneumonia of horses, C. TROESTER (*Ztschr. Veterinärk., 11 (1899), No. 7, pp. 356–364*).—Contains a discussion of the symptoms of the disease and reports on experiments for producing immunity by vaccination.

Ascending paralysis of the spinal cord in the horse, J. McCALVÉ (*Rec. Med. Vet. Paris, 8. ser., 6 (1899), No. 13, pp. 401–410, figs. 3*).—The series of symptoms takes the following order: Motor paralysis of the posterior legs, loss of sensibility in these parts; motor paralysis of the muscles of the trunk, loss of sensibility of this region; anæsthesia of the trunk, motor paralysis of the muscles of the front legs, and loss of sensibility of these parts. The author gives an account of the microscopic appearance of the spinal cord, with illustrations.

The treatment of acute laminitis with antifebrin, ST. FRIIS (*Maanedsskr. Dyrlæger, 11 (1899), No. 3, pp. 97–112*).—Gives details of numerous experiments in treating horses for this disease.

AGRICULTURAL ENGINEERING.

Irrigation engineering, L. G. CARPENTER (*Colorado Sta. Rpt. 1898, pp. 176–198*).—A brief summary is given of the work of this department of the station in the following lines: Water supply, duty of water, seepage measurements, losses from ditches and canals, and origin of seepage water.

In the study of water supply the record of the flow of the Poudre River has been continued (making a continuous record for 15 years) and rain guages have been put into the hands of observers stationed at different points in the watershed of this stream. The results of the observations on the flow of this stream have been published in local papers so that users of the water would be informed in advance of the rise or fall of the water in the stream. A table is given which shows the dates of high water during the last 15 years and the average flow for the week during which this maximum was reached. A table also shows the average flow from April 26 to November 1 during the same years. The latter shows fluctuations of from 451 cubic ft. in 1898 to 1,761 cubic ft. in 1884.

Observations on the level of water in a series of wells extending from the stream to the foothills beyond all irrigation ditches are reported.

A brief outline is given of a series of observations on duty of water which the station has undertaken at different points, and the plan and results of observations on seepage at a number of different places in the State are reported. The latter observations include measurements of seepage on the Poudre, Arkansas, Big Thompson, Little Thompson, and Rio Grande rivers and on the St. Vrain Creek. Observations on losses from ditches and canals mostly in the Arkansas Valley in continuation of those already given (E. S. R., 10, p. 795) are reported.

Irrigation in the Yakima Valley, J. SHOMAKER (*Irrig. Age, 13 (1899), No. 12, pp. 410-413*).

Irrigation, S. M. WOODBRIDGE (*South. California Acad. Sci., Agr. Exper. Sec. Bul. 7, pp. 9, figs. 5.*)—A description of methods of surface irrigation, subirrigation, and interirrigation as practiced in California.

Report of the Thebus irrigation commission, 1899 (*Cape Town: W. A. Richards & Sons, 1899, pp. 68, pls. 5, charts 9*).—This report deals with the feasibility of storing the water of Thebus River for irrigation purposes.

The water wheel, the evolution of the American type of water wheels (*Irrig. Age, 13 (1899), No. 12, pp. 416-420*).—Review of an article by W. W. Tyler in *Jour. Western Soc. Engineers, Apr., 1898.*

Artesian water in New South Wales, J. W. BOULTBEE (*Jour. and Proc. Roy. Soc. New South Wales, 32 (1898), pp. 88-103*).—Data on the number and flow of artesian wells.

The Kankakee marsh lands (*Drainage Jour., 21 (1899), No. 8, p. 201*).—A brief note on the proposed plan for draining some 500,000 acres of these lands.

Good roads for farmers, M. O. ELDRIDGE (*U. S. Dept. Agr., Farmers' Bul. 95, pp. 47, figs. 49*).—An attempt is made in this bulletin "to present in the plainest possible language the fundamental principles of road building and maintenance and to furnish instruction and advice to those whose facilities are limited and who are often supplied with but the natural materials." The topics discussed are principles which should govern location and treatment of roads—grades, drainage, water breaks, side ditches, subdrainage; different kinds of roads—earth roads, sand roads, roads of sawdust, tan bark, etc., corduroy roads, hard roads, gravel roads, shell roads, and stone roads; trees alongside of roads; and cost of roads.

Must the farmer pay for good roads? O. DORNER (*U. S. Dept. Agr., Office of Road Inquiry Circ. 31, pp. 40, figs. 43.*—This pamphlet, published by the League of American Wheelmen, and adopted as a circular of the Office of Road Inquiry of this Department, is intended to give a better understanding of the system of State aid to road building which has been in force in New Jersey for a number of years and has also been adopted in Connecticut, Pennsylvania, and New York, and is under consideration in Minnesota.

State aid to road building in Minnesota, A. B. CHOATE (*U. S. Dept. Agr., Office of Road Inquiry Circ. 32, pp. 12, figs. 5*).—By mistake this was originally issued as Circular 31 of the Office of Road Inquiry (E. S. R., 10, p. 896).

Road improvement in governors' messages, R. STONE (*U. S. Dept. Agr., Office of Road Inquiry Circ. 33, pp. 14*).—Extracts bearing on road improvement from messages of governors to the legislatures of Alabama, California, Connecticut, Delaware, Indiana, Kansas, Maryland, Missouri, New Hampshire, New York, North Carolina, Ohio, Oregon, Rhode Island, Vermont, and West Virginia.

STATISTICS—MISCELLANEOUS.

Eleventh Annual Report of Colorado Station, 1898 (*Colorado Sta. Rpt. 1898, pp. 99-235*).—This contains a financial statement for the fiscal year ending June 30, 1898; a report by the director on the station staff and the work of the station and substations during the year, including a subject list of station publications; and reports by the botanist and horticulturist, agriculturist, entomologist, chemist, meteorologist, and irrigation engineer, and the superintendents of the Rainbelt Substation at Cheyenne Wells and the Arkansas Valley Substation at Rockyford, parts of which are noted elsewhere.

Eleventh Annual Report of Georgia Station, 1898 (*Georgia Sta. Rpt. 1898, pp. 10*).—Organization list of the station; brief report on station equipment, work, and publications, and financial statement for the fiscal year ending June 30, 1898.

Eleventh Annual Report of Illinois Station, 1898 (*Illinois Sta. Rpt. 1898, pp. 16*).—The publications and principal lines of station work during the year, subject list of bulletins published since the organization of the station, financial statement for the fiscal year ending June 30, 1898, and the organization list of the station are given.

Eleventh Annual Report of Indiana Station, 1898 (*Indiana Sta. Rpt. 1898, pp. 22*).—This report covers the work of the station for the 6 months ending June 30, 1898, and includes the organization list of the station; brief reports by the director, agriculturist, horticulturist, chemist, botanist, and veterinarian, and a financial statement for the fiscal year ending June 30, 1898.

Tenth Annual Report of Kentucky Station, 1897 (*Kentucky Sta. Rpt. 1897, pp. XI + 131*).—This contains the organization list of the station; a financial report for the fiscal year ending June 30, 1897; reports by the director, chemist, entomologist and botanist, horticulturist, and meteorologist on the work during the year, and reprints of Bulletins 66-71 of the station on the following subjects: Tobacco (E. S. R., 8, pp. 976, 997), the San José scale in Kentucky (E. S. R., 9, p. 261), analyses of commercial fertilizers (E. S. R., 9, p. 338), wheat (E. S. R., 9, p. 639), the woolly mullein (*Verbascum phlomoides*) in Kentucky (E. S. R., 10, p. 359), the gape disease of poultry (E. S. R., 10, p. 393), and analyses of commercial fertilizers (E. S. R., 10, p. 337).

Annual Report of Minnesota Station, 1898 (*Minnesota Sta. Rpt. 1898, pp. XIX + 566*).—This includes the organization list of the station; list of bulletins published during the year; financial statement for the fiscal year ending June 30, 1898; report by the director outlining the results obtained in the different departments during the year; a meteorological record noted elsewhere, and reprints of Bulletins 53-59 of the station on the following subjects: Effects of the rotation of crops upon the humus content and the fertility of soils, production of humus from manures (E. S. R., 9, pp. 632, 611), human food investigations, the rational feeding of men (E. S. R., 9, p. 777), the Orthoptera of Minnesota (E. S. R., 10, p. 466), sugar beets (E. S. R., 10, p. 543), fattening lambs in winter (E. S. R., 10, p. 575), fattening steers in winter (E. S. R., 10, p. 671), and fattening lambs and wethers in winter (E. S. R., 11, p. 179).

Twelfth Annual Report of Nebraska Station, 1898 (*Nebraska Sta. Rpt. 1898, pp. 56*).—This includes a brief report on the staff, equipment, lines of experimentation, and publications of the station for the year; departmental reports, parts of which are noted elsewhere, setting forth the work of the various departments and giving results in some cases, and a financial report for the fiscal year ending June 30, 1898.

Eleventh Annual Report of Vermont Station, 1898 (*Vermont Sta. Rpt. 1898, pp. 125–404*).—This includes the organization list of the station; table of contents of the bulletins published during the year and of the report; financial statement for the fiscal year ending June 30, 1898; report by the director, briefly summarizing the results obtained in each department during the year; list of available publications, and abstracts of Bulletins 60–65 of the station on the following subjects: Insects of the year (E. S. R., 10, p. 459), hardy apples for cold climates (E. S. R., 10, p. 437), home-grown grapes in Vermont (E. S. R., 10, p. 440), and analyses of commercial fertilizers (E. S. R., 10, p. 623). The work of the departments of chemistry, botany, horticulture, apiculture, and dairy husbandry, as set forth in the different departmental reports, is noted elsewhere.

Proceedings of the twelfth annual convention of the Association of American Agricultural Colleges and Experiment Stations, A. C. TRUE, W. H. BEAL, and H. H. GOODELL (*U. S. Dept. Agr., Office of Experiment Stations Bul. 65, pp. 138*).—This gives the officers and committees of the Association, list of delegates and visitors in attendance, and the proceedings of the convention held at Washington, D. C., November 15–17, 1898, an account of which has already appeared (E. S. R., 10, p. 704).

Statistics of the land-grant colleges and agricultural experiment stations in the United States for the year ending June 30, 1898 (*U. S. Dept. Agr., Office of Experiment Stations Bul. 64, pp. 39*).—A summary of this has already appeared (E. S. R., 10, p. 1001).

Experiment Station Work—X (*U. S. Dept. Agr., Farmers' Bul. 97, pp. 32, figs. 5*).—This number contains articles on the following subjects: Manure from cows, plants for alkali soils, influence of alkali on plants, feeding value of the corn plant, sows and pigs at farrowing time, the soy bean as a feeding stuff, alfalfa hay for hogs, animal matter for poultry, water and animal diseases, construction and cooling of cheese-curing rooms, and irrigation investigations.

Suggestions to Southern farmers (*U. S. Dept. Agr., Farmers' Bul. 98, pp. 48*).—Summaries are given of 11 papers read at the Interstate Farmers' Convention held at Vicksburg, Miss., February 8–10, 1899, as follows: Mississippi soils and their capabilities, W. L. Hutchinson; The dairy cow as a restorer of fertility, T. L. Haecker; Cotton seed and its products, B. W. Kilgore; The relation of live-stock farming to home-making, V. C Meredith; Southern agriculture, Mississippi and Louisiana, W. C. Stubbs; Expansion in the farmer and the farmer in expansion, W. M. Beardshear; Horticulture, G. H. Van Houten; Agricultural education, W M. Liggett; Stock and how to feed them, W C. Welborn; The peculiar advantages of the South for growing forage crops and feeding stock, W. R. Dodson and The Weather Bureau and the farmer, W. L. Moore.

Report on the condition of winter grain on April 1, 1899, and the losses of farm animals during the year ending March 31, 1899, with statistics of foreign crops, J. HYDE (*U. S. Dept. Agr., Division of Statistics Rpt. [illegible] n. ser., pp. 38*).—During the year ending March 31, 1899, the total loss of farm [illegible]s in the United States from exposure and disease "was over 7,500,000 head, of which swine constituted 11.9 per cent, sheep 29.2 per cent, cattle 24.7 per cent, and horses 1.2 per cent. . . . On the basis of the average values, as ascertained on January 1 last, the estimated loss from exposure aggregated about $26,000,000, and that from disease about $49,000,000, or a total of $75,000,000, five-sixths of which may be said to be theoretically preventable."

Crop circulars for May, June, July, and August, 1899, J. HYDE (*U. S. Dept. Agr., Division of Statistics Crop Circs. May, June, July, and Aug., pp. 20*).—These contain the usual data relative to conditions of farm and orchard crops during these months, with summarized temperature and rainfall records for the same periods, and a discussion of the foreign crop situation.

NOTES.

Idaho Station.—The board of regents is at present constituted as follows: President, G. A. Roberthan, of Pocatello; vice-president, F. N. Gilbert, of Moscow: secretary, F. E. Cornwall, of Moscow; A. H. Alford, of Lewiston; J. B. Goode, of Cœur d'Alene; C. E. Harris, of Montpelier; J. E. Hickman, of Preston; and Mrs. Geo. Williams, of Hailey. Samuel Avery, Ph. D., formerly of the University of Nebraska, has succeeded C. W. McCurdy as chemist. A new farmhouse, a silo with a capacity of 75 tons of corn, and additions to the farm barns have been built. Considerable new fencing has also been built. The farm experiments with potatoes and fodder plants are now being conducted, and feeding experiments will soon be begun.

Maine Station.—The station has just completed, at a cost of about $3,500, an addition to the office and laboratory building, 22 by 28 ft. The basement will be used as a calorimeter room, the main floor as a food laboratory, and the second floor as the director's office and library.

Massachusetts Hatch Station.—H. T. Fernald, formerly professor of zoology in the Pennsylvania State College and State economic zoologist, has been appointed associate entomologist of this station.

New Mexico Station.—J. D. Tinsley has been given leave of absence for two months for the purpose of study in the Division of Soils in this Department. He has recently been assigned to work in soil physics and meteorology, instead of biology, as formerly. C. A. Keffer, agriculturist and horticulturist, has been elected horticulturist of the Tennessee college and station.

Ohio Station.—The board of control has been reorganized by the election of J. T. Robinson as president. J. W. T. Duvel, assistant botanist, resigned October 28 to accept a fellowship in chemical biology at the University of Michigan.

Oklahoma College and Station.—There has been a marked increase in attendance in the college, 259 students being enrolled. The total enrollment for last year was 219. The purchase of 3 Herefords and 3 Shorthorns has been made by the college. A ten weeks' course in agriculture, horticulture, and mechanics will be given during the winter term. The new building for the joint use of the departments of chemistry in the college and station is completed. The building is of brick, the college portion being 40 by 60 ft. and two stories, and the station portion a one-story and basement wing 30 by 50 ft.

Meeting of the American Pomological Society.—The twenty-sixth biennial session of the American Pomological Society, held at Philadelphia September 7 and 8, 1899, was distinguished by a large and enthusiastic attendance of representative horticulturists from all parts of the country. The number of accredited delegates present was about 150. A considerable number of experiment station horticulturists were present and read papers or took part in the discussions.

The meeting was presided over by C. L. Watrous, who, in his presidential address, called attention to the present needs of American pomology, urging, among other things, the necessity of carrying on fruit breeding as systematically as stock breeding, of being guided by isothermal rather than territorial lines in fruit planting, and of establishing a national herbarium of pomology as a check upon fraud.

Thomas Meehan spoke of Philadelphia's contribution to the history of pomology. The list of contributions includes the Seckel and Kieffer pears, and the Bartram, Alexander, and Maxatawney grapes, the last of which was the first good white grape of American origin.

J. H. Hale spoke upon the subject of Culture, stating that in a dry season the orchard should be cultivated twice a week until the fruit has developed.

L. O. Howard spoke of the present status of Smyrna fig culture in California, with special reference to the Blastophaga. The recent successful importation of the Blastophaga by this Department, in the speaker's opinion, renders Smyrna fig culture practicable in California.

Nomenclature and systematic pomology was the subject of a paper by F. A. Waugh, enumerating the rules formulated by the Cornell Lazy Club, already referred to in these pages (E. S. R., 10, p. 712), and discussed their application. The secretary read a paper by T. V. Munson on Revision and control of horticultural nomenclature, which advocated the enactment of legislation prohibiting the renaming of varieties or the publication of false descriptions of fruits. It was recommended that the supervision of pomological nomenclature be placed in charge of the Division of Pomology of this Department. The reading of these two papers gave rise to a discussion as to the methods of carrying out the suggestions, resulting in its reference to a committee.

W. R. Lazenby presented a paper on The origin and development of buds in certain fruit plants, in which the different kinds of fruit buds were distinguished and classified. J. C. Whitten spoke of the Relation of color to the growth of flower buds of the peach, referring to his experiments in the artificial whitening of trees to retard growth (E. S. R., 9, p. 835).

The first evening there were two stereopticon lectures, one by H. J. Webber on Systematic plant breeding, illustrating its possibilities by work with the orange, and the other by W. T. Swingle on Fruit culture in the Mediterranean countries

G. H. Powell presented a paper on the Importance of the plant individual in horticultural operations, in which a number of examples of individual variation were cited. The preeminent importance of aristocratic blood in fruit propagation was emphasized. For developing an aristocracy among trees pedigrees are essential. Pedigree plants differ from selected plants in that the genealogy of the latter has just begun.

W. M. Munson spoke of The blueberry, its past, present, and future, giving an account of the work with this plant at the Maine Station, and briefly reviewing other cultural experiments in this country.

American horticulture at Paris in 1900 was discussed in a paper by G. B. Brackett, which outlined the purposes and plans of the American exhibit.

J. W. Kerr spoke on The evils attendant on prevailing methods of marketing. The discussion that followed the reading of this paper brought out the point that methods of marketing fruit are changing and that many of the present evils will probably soon be remedied.

W. B. Alwood, in a paper on The technique of apple growing in Virginia, called attention to the peculiar adaptabilities of different soils of the State for apple culture. J. Craig spoke on Some results of the freeze of 1898-99 in Iowa, discussing root killing of fruit trees in the Northwest, and gave an account of experiments in cutting back trees injured by freezing and in banking trees after the freeze. G. L. Taber presented Some fruit notes from Florida, particularly on the damage done by the severe freeze of last winter to the orange orchards. H. E. Van Deman spoke of The relations of commercial fertilizers and soiling crops to fruit culture, and advocated the use of leguminous plants as sources of nitrogen for fruit crops.

In a paper on The breeding of fruits for the prairies C. G. Patten asserted that the problem of adapting fruits to the Northwest is almost exclusively one of breeding.

In addition to these papers the following were read by title and will be published in the proceedings of the society: Improvement of American grapes, S. A. Beach; Fruit evaporation, J. R. Caldwell; American plums for America, E. S. Goff; Horticultural schools of the high-school grade, S. B. Green; Orcharding in Montana, S. M. Emery; Fruit culture in the Hawaiian Islands, C. E. Hoskins; The future of commercial orcharding in the South, F. S. Earle; The Russian remedy for root killing of apple trees, N. E. Hansen, and Quality as a factor in apple culture, C. W. Garfield.

The report of the committee on revision of catalogue was read by the chairman, W. H. Ragan. It was suggested that the plan of catalogue revision be broadened by sending out a special form of inquiry concerning the behavior of fruits and ascertaining their ratings by a large number of practical fruit growers instead of by a comparatively limited number, as at present.

F. M. Hexamer, as chairman of the committee on new native fruit, reported upon the most promising varieties of apples, peaches, grapes, strawberries, and black raspberries.

The report of the committee on the awards of medals was presented by the chairman, F. M. Hexamer. Silver medals were awarded to the New Jersey State Horticultural Society, to Ellwanger & Barry, to the Arkansas Experiment Station, to the Michigan Substation at South Haven, to the Pomona nurseries, to Roland Morrill, and to John Charlton. Three bronze medals were also awarded, and honorable mention given to eleven exhibitors.

The officers elected for the ensuing year were: President, Charles L. Watrous, Des Moines, Iowa; first vice-president, Thomas Meehan, Germantown, Pa.; secretary, W. A. Taylor, Washington, D. C.; treasurer, L. R. Taft, Agricultural College, Mich.

EXPERIMENT STATION RECORD.

VOL. XI. No. 5.

The object and purpose of the experiment stations, and the best means of realizing them, has been a frequent subject of discussion ever since the passage of the Hatch Act. While it is generally recognized that the stations are primarily for investigation and not for elementary instruction, the popularity of compiled bulletins, institute work, reading courses, and other forms of general instruction has more than once threatened to carry a station off its feet and swamp its work of investigation. An instance of a tendency to give considerable prominence to these features is found in a recent statement by a station officer of long standing. In discussing the means of bringing the station work nearer to the farmers and gardeners of the State, he strongly advocates the popular bulletin, and an extensive correspondence with the farmers, encouraging them "to write to the station on every problem that they meet," these letters to be answered "promptly and as fully as possible," and where feasible published in weekly press bulletins.

He believes the building up of a large general correspondence to be the most successful way in which the stations everywhere can get closer to their constituents, and while he admits that this will involve a large amount of labor on the part of station officers, he holds that "that is what we are here for, largely." He is convinced that "more direct good is done to the farmer by those who stand in the gap and translate the results of the scientist into the language of the farm, than is done by those who content themselves with the investigations of the matters under study and confine themselves to tabulated bulletins of a scientific character, which the farmer does not read." As a further means of carrying out this conception of the station, "the organization of reading clubs under the direction of the station officers," farmers' institute work and an extension of this to "work at teachers' institutes in the line of nature studies" and "the issuing of leaflets of an instructive character," are advocated. Evidently the writer realizes that this programme will make serious inroads on the time which the average station worker has at his disposal after attending to his duties as a college professor, for he concludes with an expression of hope that he may "see the time when the station officers will be engaged solely in station work and its extension to the tillers of the soil and the teachers of our schools," and believes that then "the college can get students better fitted for the taking up of scientific work and more enthusiastic in the study of nature and her problems."

It is interesting to note that the writer concludes an enumeration of the lines of work which he has in progress with the hope that in the future his division "may be able to show some results from investigation, as well as to publish information bulletins of a popular character."

The presidential address of Dr. H. P. Armsby before the recent convention of the Association of American Agricultural Colleges and Experiment Stations bears directly upon this subject, and states it from a different point of view. As he looks at it, "the function of the experiment station is not the impossible task of giving him [the farmer] recipes suited to every conceivable emergency. Its business is to enlarge his knowledge of the natural forces which drive his farm, as the steam drives the engine, and to teach him to control them instead of being controlled by them. It is not a device to save the farmer the trouble of thinking. On the contrary, its constant and insistent demand is that he think more. It can help him permanently and effectively only to the extent to which he can by such thinking digest and assimilate its help."

Dr. Armsby conceived the experiment station to be fundamentally and in its broadest sense an educational institution—not designed to do the work of the agricultural college, the farmers' institute, reading and correspondence courses, or the agricultural press, but rather the "fountain from which shall flow the stream of knowledge and inspiration which shall fructify and vivify this vast system." The nature of its educational work was held to be essentially higher than that of the agricultural college—the education which comes from and through research; and he believed that any large amount of elementary undergraduate instruction was incompatible with the most efficient station work. "The experiment station, in method and spirit, is the agricultural university, the school of the specialist, the teacher of the teachers, the head and crown of the whole system. If this be true, how unwise from an educational standpoint to hamper and dwarf it by requiring work of a lower grade. . . . Still less does the work of primary and secondary education belong to it. It is not its function to distribute general agricultural information through its bulletins and reports. It is not called upon to aid directly in the introduction of nature studies into the schools nor in the conduct of correspondence courses, nor to systematically attend farmers' institutes, nor, except incidentally, to act as a bureau of information. . . . It is an unfortunate and mischievous confusion of ideas which looks upon these [various means for bringing the results of science to the people] and even officially designates them in station publications and State laws as experiment-station work. The ideas of the general public regarding the work of the stations are hazy enough at best. Let us not add to their confusion. All these things are things of the utmost, perhaps of paramount, immediate importance, but they are not *station* work. They are all forms of teaching, and teaching is the business of the school, and not of the station. The central idea of the station is research—the discovery and promulgation of new truth."

These statements were made with a full appreciation of the popularity and the utility of extended correspondence with farmers, of popular compiled bulletins, institute work, etc., and with a realization of the urgent need for general instruction in the elementary principles of agriculture. But the very fact that the station is the source from which the supply of new knowledge is derived makes it imperative that it should be allowed to specialize and devote itself mainly to the acquisition of knowledge, which will be expounded and diffused and given practical application by agricultural instructors, institute workers, writers, and other means. "When we dry up the springs among the hills, the mills along the river will sooner or later cease to grind. It is in the educational function of the station that we find the true reason for holding strictly to the historical conception embodied in section 2 of the Hatch Act, and when we defend this conception against those who would make of the station a school or a tract society, we are defending the highest interests of the farmers themselves."

The difficulty which many people seem to have in determining the proper functions of the experiment station grows in large measure out of the complex organization of our stations and their intimate relations with the agricultural colleges. The error is often made of giving undue prominence to the direct and immediate benefit which the station may confer upon the farmer through advice and instruction, without realizing that experimentation must precede this popular education and must be relied upon as the fundamental means of advancing agriculture. The various means employed for diffusing popular agricultural information are assuredly useful and worthy in their place, and no doubt abundant appreciation is shown for the efforts to give immediate aid to the farmer through popular bulletins, extensive correspondence, newspaper articles, etc. The farmers need such instruction and the States would do well to provide it for them through the agricultural colleges or boards of agriculture. In fact, we believe that those agricultural colleges which find it a difficult matter to secure students in their regular courses would do well to exert themselves strenuously in endeavors to reach the farmers through different forms of university extension. We also hold that it is the duty of experiment station officers to present such accounts of their work as are intended for the farmers' use in the most attractive and readable form. Necessarily the records of elaborate investigations will often be tedious reading for all except specialists. The wise station will not overload its bulletins for farmers with such details.

But, on the other hand, we believe more firmly than ever that those station officers who are charmed with the popular applause which follows the publication of compiled information are in great danger of suffering loss of professional standing through diversion from their work as investigators, and of so weakening the stations whom they serve that in a comparatively brief time they will lose the respect and confidence of the farmers. We believe that an impartial appeal to the record would show cases in which the progressive work of station officers had been materially reduced in amount and quality because of their increasing engrossment in various educational enterprises. We are sure, also, that it is those stations which have most closely adhered to the fundamental conception that they are institutions for research, which have attained the greatest measure of success in the eyes of practical men. For, after all, thorough work tells, and the farmers can discern superficiality as well as any other men. To them it is obvious that an experiment station is established to experiment, and as soon as the genuine experimental work produced by any station diminishes materially in amount and quality all the clamor raised by an outpouring of letters, lectures, and press notices will not serve to hide from them the fact that that station has degenerated.

With so large and important a field as our experiment stations have to fill in the performance of their legitimate service, it is hard to see why they should think of abandoning it to do the work which other institutions are especially created to perform. Never has there been so great a demand on the part of practical men for definite solutions for agricultural problems which can only be obtained by thorough original investigations, and whenever success attends such investigations the appreciation of the public is shown in a decided and substantial manner. Investigators have therefore great encouragement to persist in their researches, and can well afford to let those who prefer to diffuse information rather than increase knowledge go their way and to rejoice with them in whatever success may attend their labors.

THIRTEENTH ANNUAL CONVENTION OF THE ASSOCIATION OF AMERICAN AGRICULTURAL COLLEGES AND EXPERIMENT STATIONS.

E. W. ALLEN,
Office of Experiment Stations.

For the second time in the history of the Association the meeting of 1899 was held in the far West, affording an opportunity for the delegates from the East to study the agricultural conditions and problems of the western States, and making it possible for an unusually large number of delegates from institutions west of the Mississippi to attend. The convention met in San Francisco, California, July 5–7, in conjunction with the Association of Official Agricultural Chemists (see p. 204). Delegates and visitors were present from 34 States and Territories, representing about 60 institutions.

Advantage was taken of the reduced railroad fare to California secured by the meeting of the National Educational Association at Los Angeles, and a large number of the delegates from the East met at Chicago and journeyed across the continent together in cars chartered for the party. The magnificent hospitality and the many courtesies extended to the delegates and their friends by individuals and representatives of various organizations, and the opportunity furnished by the week of excursions to view the different agricultural features of the State, made the convention a notable one in the history of the Association.

GENERAL SESSIONS.

The general sessions were held in the assembly hall of the Academy of Science, and the section meetings in the parlors of the Occidental Hotel and in rooms in the Mills Building, near by. H. P. Armsby, director of the Pennsylvania Experiment Station, presided over the general sessions and delivered the presidential address. This was a scholarly presentation of the experiment station ideal. The speaker conceived the experiment station to be primarily and in its broadest sense an educational institution—not an institution to furnish the farmer with recipes for his work, but to enlarge his knowledge of the principles and to strengthen his ability to intelligently apply them in practice. Ideally the station should be the source of knowledge and inspiration for the agricultural college—the capstone of agricultural education. Being an institution for higher education in agriculture, it should be divorced as fully as possible from the routine of elementary instruction, which was regarded as a dissipation of the energy of the station investigator. He made it very plain that the station is for investigation rather than for popular education, and insisted that this should be the central idea, whatever else the stations do. In conformity with this ideal, the qualifications of station workers and of the director were considered. The "director who inspires" was regarded as the ideal rather than the "director who directs."

A telegram of greeting was received from the Secretary of Agriculture.

Resolutions of sympathy were adopted for E. W. Hilgard, director of the California Station, who was prevented by illness from attending the convention which he had urged so cordially to meet in San Francisco.

The report of the executive committee was read by H. H. Goodell. It suggested a plan for making the work of the sections of the Association more effective by limiting the number of topics, discussing methods rather than the results of work, especially such results as have already been published in bulletins or annual reports, and selecting such subjects as will open up a field for investigation. The subject of military detail to land-grant colleges had received the attention of the committee, but without satisfactory outcome. Following the death of Senator Morrill the committee invited M. H. Buckham to prepare resolutions in memory of the late Senator, and G. W. Atherton to prepare an address on his life and services, and recommended the observance by the colleges of April 14, 1899, as Morrill day. The bust of Senator Morrill belonging to the Association had been tendered to the Library Committee of Congress, with the suggestion that it be placed in the Congressional Library. The work of various special committees appointed at the last convention was briefly reviewed; and reference was made to the Free Homestead Bill and its possible effect on the funds of the land-grant colleges.

The report of the treasurer was presented, showing a balance of over $1,000 in the treasury.

The report of the chairman of the section on agriculture and chemistry was read by J. L. Hills. He reviewed the experimental work which had been in progress during the year, and discussed the effect of the inspection work on the research work of the stations. He pointed out the dangers from this police work where suitable provision for its execution is not made, and suggested that by organization, deputization, and employment of special assistants, the interference of this inspection work with the regular research work of the station could be minimized.

The report from the section on mechanic arts was presented by C. S. Murkland, who touched upon the proposed legislation for the establishment of engineering experiment stations, and pointed out that the experimental work in mechanic arts was largely being carried on with the assistance of students rather than by special investigators. He gave some illustrations of the work in progress in this line, and brought out the value of work in mechanic arts for developing force in the student.

The report from the section on horticulture and botany was read by L. H. Pammel. He discussed the required work in botany in the colleges, and advocated greater uniformity in this respect. He gave statistics of the number of students and the special lines of botanical work which they pursue. The importance of giving more attention to instruction in physiological botany was emphasized. The collections of the horticultural and botanical departments were discussed, showing that few institutions have garden herbaria. In conclusion the lines of station work in horticulture and botany were enumerated.

The report for the section on entomology was read by C. W. Woodworth, who discussed the inspection work, especially for the San José scale, and gave a survey of the work of investigation and teaching done by the entomologists.

No report was presented from the section on college work.

Elwood Mead announced the meeting of the National Irrigation Congress at Missoula, Mont., in September, and urged the importance of the stations in the irrigated region participating in this congress.

The report of the bibliographer was presented by A. C. True, who also made a brief report for the committee on indexing agricultural literature.

H. P. Armsby presented a report on the station exhibit at the Paris Exposition, giving an outline of the general plan of the exhibit and the material promised by the stations.

By appointment, M. H. Buckham pronounced a graceful and discriminating eulogy on the late Senator Justin S. Morrill, and introduced memorial resolutions. In discussing the Morrill Act the speaker showed that the intention of its author was to provide an education that should be first liberal and then practical, as adapted to the needs of the industrial classes. His central idea was to liberalize the industries and lift them to the plane hitherto occupied alone by the professions, an idea which the speaker held to be unique, and the crystallization of which he declared to be one of the great epoch-making acts of the American Nation. The resolutions were seconded by J. K. Patterson in an eloquent tribute to the greatness of Senator Morrill, and were unanimously adopted by a rising vote of the convention.

The fourth report of the committee on methods of teaching agriculture was read by A. C. True, secretary of the committee. This report presented a syllabus of a course in zootechny, which was limited to the theory and practice of the production of the normal useful animal. Zootechny was divided by the committee into three main branches, (1) types and breeds of useful animals, (2) feeding, and (3) hygiene and management. An interesting discussion followed this report, in which some of the difficulties in separating instruction in technical agriculture from that in agricultural chemistry, economic botany, soil physics, and other related sciences were pointed out. The committee was continued.

Two papers were presented from the section on horticulture and botany. The first was by E. J. Wickson, on Climatology and horticulture. It was pointed out that while the botanists have studied the effect of various factors on plant growth, the horticulturists have done almost nothing to determine the relation between climate and horticulture. Some of the unexplained relations of environment to quality of fruit, development of color, and flavor of fruits under different environment and at different elevations were enumerated. These matters are frequently very important and were believed to afford a profitable field for research. Systematic investigation, it was thought, might assist in clearing up the vague condition of knowledge in this direction.

The other paper from this section was on Methods of seed testing and their relation to the farm and garden, by A. J. Pieters. The author spoke of the prevalence and evils of seed adulteration, resulting not only in diminished crops but in the introduction of injurious weeds. He showed by some actual examples the material financial loss from buying cheap seeds, and urged that experiment stations could do much to arouse an interest in and intelligent understanding of the subject. He believed that guaranteed seed would be put upon the market by seedsmen as soon as there was a demand for it. He described some of the simple methods of seed testing and their use by the small grower and the farmer.

Two papers were also presented from the section on college work. The first was by W. M. Liggett, on Agricultural education, practical and scientific. In this paper he described particularly the course of study at the Minnesota School of Agriculture, and mentioned the work which that institution is doing. The other paper treated of The principles underlying the formation of an agricultural course in the South, and was by C. E. Coates. The course in agriculture at the Louisiana State University was outlined, and the increasing success in securing students for the agricultural course was referred to. The ideas which have governed in elaborating this course and the principles which have been kept in mind in its formation were enumerated.

W. A. Withers presented an encouraging report from the committee appointed to attend the Second National Pure Food and Drug Congress, indicating that the outlook for legislation in the near future is hopeful.

No report was presented by the committee on graduate study, but A. C. True explained a plan for such study in the Department of Agriculture (E. S. R., 11, p. 1). This committee was continued, and J. E. Stubbs and A. C. True were appointed to fill the vacancies caused by the resignation of G. E. MacLean and Alston Ellis, who have severed their connection with the Association.

There was a quite general discussion of the subject of cooperation between the experiment stations and the divisions of this Department. Attention was called to the increasing amount of cooperation in recent years, and to the fact that Congress is recognizing the opportunity which the stations afford for extending the investigations of the National Department. As the work of the stations becomes more specialized and they take hold of the larger agricultural problems affecting whole regions of the country, there is greater interest manifested in arranging for cooperation with the Department and in securing funds from Congress for this purpose. In view of the increasing importance of the subject, it was suggested that the arrangements for cooperation between the Department and the stations would naturally assume a more formal character, and a committee of five was appointed to consider the basis and methods of such cooperation and report at the next meeting. The committee consists of E. A. Bryan, H. H. Goodell, W. A. Henry, H. J. Waters, and L. G. Carpenter.

A proposition from the section on mechanic arts, relative to the publication of abstracts of its papers, developed considerable discussion on the practicability of publishing in full or in abstract all the papers presented before the various sections. There was a feeling among a considerable number that all papers should be published, and that the assurance of publication would tend to improve the character of the papers presented.

A resolution was adopted to the effect that "this Association petition Congress that such measures be taken as shall secure the delivery of the public documents [of executive departments] to depository libraries at the earliest practicable moment, and that the executive committee be instructed to bring the matter to the attention of the proper committees of the two Houses."

The executive committee was instructed to secure a place upon the programme of the National Educational Association of 1900, for the presentation of a paper on the scope and mission of the land-grant colleges in our American system of education.

A committee, consisting of J. E. Stubbs, M. H. Buckham, J. K. Patterson, W. A. Henry, and H. H. Goodell, was appointed to consider the revision of the constitution of the Association and report at the next convention, the appointment of the committee being accepted by the Association as due notice of any changes the committee may recommend.

At one of the evening sessions A. G. McAdie, the local weather observer at San Francisco, gave an interesting address, illustrated with stereopticon views, on the climate of California.

Following the afternoon sessions on the last day of the convention, a reception was given the members of the Association by the State Floral Association of California in the parlors of the Occidental Hotel. A beautiful display of flowers was exhibited, some of the varieties or crosses representing the latest achievement of the originators.

An invitation was extended to the Association to hold its next meeting at New Haven or Middletown, Conn., next year marking the twenty-fifth anniversary of the establishment of the first experiment station in this country. Invitations were also read from the people of Jacksonville, Fla., and Saratoga Springs and Niagara Falls, N. Y. The matter was referred to the executive committee.

The officers elected for the ensuing year are as follows:

President, J. E. Stubbs, of Nevada; vice-presidents, E. W. Hilgard of California, J. M. Stone of Mississippi, E. E. Smiley of Wyoming, M. H. Buckham of Vermont, and M. A. Scovell of Kentucky; secretary and treasurer, E. B. Voorhees, of New Jersey; executive committee, H. H. Goodell of Massachusetts, W. M. Liggett of Minnesota, J. H. Washburn of Rhode Island, and Alexis Cope of Ohio; bibliographer, A. C. True, of Washington, D. C.

Section on college work.—Chairman, J. K. Patterson, of Kentucky; secretary, A. W. Harris, of Maine.

Section on agriculture and chemistry.—Chairman, L. G. Carpenter, of Colorado; secretary, C. D. Woods, of Maine.

Section on horticulture and botany.—Chairman, S. A. Beach, of New York; secretary, P. H. Rolfs, of South Carolina.

Section on entomology.—Chairman, H. Garman, of Kentucky; secretary, W. G. Johnson, of Maryland.

Section on mechanic arts.—Chairman, C. S. Murkland, of New Hampshire; secretary, F. P. Anderson, of Kentucky.

MEETINGS OF SECTIONS.

SECTION ON AGRICULTURE AND CHEMISTRY.

In this section three topics were selected which are of prime importance in the West, namely, alkali soils, irrigation, and range feeding of cattle. One session was devoted to each topic, and the papers and discussion were confined to the topic under consideration.

R. H. Loughridge discussed the alkali soils of the Pacific Coast and their utilization. He gave a clear disquisition on the general subject of alkali, and brought out the distinction between black and white alkali, which he recommended should be made in speaking of alkali. A third form, saline alkali, is found in southern California. He discussed the variation in the composition of alkali, and its effects upon soil and vegetation; and described the alkali regions of California, illustrating this by a map. The reclamation of black alkali land by the use of gypsum, as proposed by the California Station, was referred to. This has been successfully carried out at the substation at Tulare, Cal., wheat now being grown where formerly there was no vegetation except something like the saltbush; and large farms in central California have also been reclaimed by gypsum. "The rapidity of action of the gypsum is surprising. Experiments made in our laboratory show that where the gypsum is in sufficient amounts, and moisture is present, the change is within 24 hours. Whether it would be as quick as that upon lands I am unable to say, but in laboratory experiments the change was very rapid." The study of the vegetation on alkali lands, which is one of the features of the alkali work of the California Station, was thought to promise excellent results.

In a paper on Recent investigations by the Wyoming Experiment Station in alkali and irrigation, B. C. Buffum discussed the alkali soils of Wyoming, and reported upon the work which the station has done on the effects of the different alkali salts on seed germination and plant growth. He discussed the action of alkali, and the relation between the amount of moisture and this action, showing the connection between alkali studies and irrigation investigations in an alkali country. He showed by means of charts that alkali has a stimulating effect on the germination of seeds and on the subsequent growth, when the alkali salts, especially sodium carbonate, are not too high. He pointed out the relation which had been found between the absorption of alkali water by seeds, and osmotic pressure; and showed that the effect of alkali on germination of seeds is a physical and not a physiological one. In general, the number of seeds germinated at a given date was found to be inversely proportional to the osmotic pressure of the alkali solutions in which they were placed. The remedies for alkali soils were reviewed, such as leaching out the salts, preventing the accumulation of salts by controlling the evaporation, and growing useful plants which take it up. The possibility of the adaptation of plants to alkali soils was suggested.

A. Goss, of New Mexico, discussed the alkali soils of that Territory. In the Rio Grande Valley the water contains gypsum which would change any black alkali that might be present in the soil to white alkali. Hence only white alkali is found. Black alkali is found over restricted areas in New Mexico, notably in the Animas Valley. He described the "chico spots," containing considerable amounts of carbonate of soda, on which seeds will not germinate. The origin of these spots is attributed to the chico bush,[1] which accumulates the carbonate of soda near the surface. The speaker also discussed the plant food furnished by alkali, notably potash. Studies of the water of the Rio Grande have shown that irrigation furnishes the soil with more potash than an ordinary crop will remove.

F. W. Traphagen, of Montana, discussed the alkali of that State. The source of alkali in Montana is traced mainly to the marine shales. As a result of overirrigation the alkali rises and accumulates near the surface. This was illustrated by the results of experiments; in some cases 64 per cent of the alkali in the first 9 ft. of soil was concentrated in the first 2 ft. of soil by overirrigation. The value of washing as a means of removing alkali was shown by the amount of alkali which is being removed by the Yellowstone River, observations for 12 days showing an average of 400 tons per day. Data were presented to show the value of alfalfa as a preventive of alkali. "This crop has a remarkable power to prevent the rise of the alkali, and would seem to slowly remove it, for the very heavy crops, containing a considerable amount of mineral matter, a large portion of which is alkali salts, must remove very large quantities of alkali in the aggregate. My observations have caused me to believe that if a stand of alfalfa can be secured, and the water table kept low enough for all fields where such conditions prevail, the alkali problem is solved."

---

[1] Greasewood (*Sarcobatus vermiculatus*).

Other speakers brought out the value of alkali as a fertilizer, and for holding the water and retaining the soil moisture. With the rise of alkali, it was stated, there has been a rise of the ground water.

The discussion of the subject of irrigation was opened by L. G. Carpenter in a paper on Some of the general features of the problem of irrigation in the West. He discussed the question of water rights, and the difficulty of adjusting these matters equitably. He showed by charts the economy and waste in the use of irrigation water in practice on different farms. The amount of water used was said to be governed largely by the water supply rather than by the actual needs of the crop. "A comparatively small proportion, in many cases at least, is applied usefully; that is, to such a degree that the plant can use it and does use it in its growth. Much more passes away into the soil or air by evaporation from the soil." From a theoretical point of view, irrigation resolves itself into a question of soil moisture and its conservation. The fertilizing value of irrigation waters was referred to; and the effect of the temperature of the water on the temperature of the soil to which it is applied, and hence in controlling the growth of the plant under irrigation, was noted as a very important feature.

A. C. True and Elwood Mead spoke of the work which the Department of Agriculture has undertaken in irrigation investigations.

E. J. Wickson read a paper entitled Notes on irrigation of deciduous fruits, which embodied some of the more prominent facts learned from practice in the use of water for orchard fruits. He showed the advantages of irrigation, not only in the greater health, vigor, and productiveness of trees, but also in the appearance and quality of the fruit. He refuted the claim of some horticulturists that better fruit can be grown without irrigation. He maintained that "it is impossible to set up arbitrarily any exact standard of the moisture requirements of plants in terms of rainfall." The signs of need of irrigation, and the proper use of water to control growth and remedy unthrifty condition of trees were noted.

Other speakers called attention to the depletion of many of the western soils in humus, and the relation of humus to the retention of water. They advocated keeping up the humus by growing leguminous crops in place of summer fallow. A search for forage crops which are able to grow with a minimum amount of water was suggested as extremely desirable for semiarid regions.

Upon the third subject, Range feeding of cattle, a short paper by W. W. Cooke was read. C. D. Smith spoke on the Possibilities of developing high-class dairy cows from grade stock of the range type. He gave the results of experiments at the Michigan Station with good grade cows selected in the State and in the West. The results were held to show that feeding and care are very important factors and may do much to overcome the effects of type. "After all, one of the main questions in the dairy business is the careful, judicious feeding of the cows, and not primarily alone the selection of cows of a high type. I therefore say that among other possibilities of the Shorthorn and other cows of the range type comes a possibility of high production along dairy lines. No man can make of a [poor] cow a high-type dairy animal, but a good feeder may take the average range cow and expect to develop from that in a single year a herd of cows averaging 300 lbs. of butter." This paper developed considerable discussion, and it was contended that the statements regarding "range" cows should be qualified so as to exclude certain classes of range animals.

H. T. French presented the subject of Finishing range cattle in the stall. He referred to the changed conditions in the Northwest regarding the management of range cattle since the extensive introduction of sheep on the range. While formerly cattle could be finished on the range almost the year round, "now there are only a few months on that range that cattle are considered finished for the butcher." As a remedy, the growing of grasses, alfalfa, and clovers on which steers can be finished in the field, and stall feeding were suggested. Stall feeding of range steers unaccustomed to being handled was regarded as entirely practicable, and it was stated that steers so treated do well and take on fat very rapidly. Experiments by the speaker at the Oregon Station were cited in proof of this. The value of wheat, barley, and oats for fattening steers where corn can not be grown was discussed. It was believed that in the West these materials might be economically used.

H. P. Armsby gave a résumé of The present status of knowledge concerning the available energy of feeding stuffs. The available energy, or, as he preferred to call it, the net energy, is equivalent to the difference between the gross energy of the food and that of the excretory products. The calculation of energy from the digestible food materials was discussed, and the conclusion was reached that we have not yet progressed far enough to formulate feeding standards in terms of energy.

A paper entitled Notes on a preliminary catalogue of plants poisonous to stock was read by V. K. Chesnut. This paper developed considerable interest, as the subject is one of importance in range feeding and is receiving attention at several of the western stations.

SECTION ON HORTICULTURE AND BOTANY.

One of the chief horticultural features of the California meeting was a visit of the horticulturists, by special invitation, to the nurseries and gardens of Luther Burbank at Santa Rosa and Sebastopol. A most interesting day was spent with this famous originator in inspecting his work and studying his methods. To allow time for this visit only two sessions of the section were held, and as a result a number of the papers were read by title. Two of the papers of this section, by E. J. Wickson and A. J. Pieters, were read in general session (see p. 408).

An interesting discussion was aroused by a paper read before the section on Inspection of nursery stock and orchards, by Alexander Craw, quarantine officer of the California State Board of Horticulture. A historical review was given of the situation in the State of California as to insect pests, their spread and control; followed by a description of the present conditions, and the methods of inspection and fumigation followed. "Riverside, San Bernardino, and some other counties have a very complete system of orchard inspection and use printed charts, with the rows and cross rows of trees blocked out and numbered thereon. When a tree is found infested with a pest a designating mark is placed on it and at the intersection of the chart corresponding to where the tree stands. After the orchard is inspected the chart is turned over to the foreman of the fumigating crew and the infested trees can be readily located and treated. Orchards are fumigated after sundown, as the gas is more effective; so this work is done during the night. All fumigating should be performed then or in a shaded place. In districts where infection is more general the entire orchard is fumigated." The inspection of nursery stock brought into the State from other countries was described as very rigid. "I frequently notice trees in cases for the East infested with that serious and difficult to destroy scale, *Diaspis amygdali.* When this scale is found on stock for California it means the destruction of the plants or trees, as we never give it any quarters. In the case of the eastern trees, we can not stop them, as we operate under a State law, unless the trees and plants are infested with insects of such a character that they would endanger the State in passing through."

B. M. Lelong described the method of destroying injurious insects by insect parasites, the climate being too dry for the development of fungus parasites. A serious melon and cucumber pest was reported, the larvæ of which were found in much imported fruit of these plants. He believed there was practically no danger from fruit shipments from infested orchards, as the covering of the fruit is so soon destroyed.

A. J. McClatchie read a paper on Irrigation methods in orchards. He considered the subject under the three heads of (1) methods of applying the water, (2) amount of water, and (3) time of applying. Experiments made by the author at Phenix, Ariz., in irrigating a peach and apricot orchard in winter were reported, the object being to ascertain in how far this might replace the customary frequent irrigation in summer, when water is less abundant and evaporation greatest. Deep saturation in the winter gave satisfactory results, water settling to a depth of 25 ft., while in summer irrigation it reached only 3 or 4 ft.

below the surface. Roots of the trees were found abundantly 14 to 16 ft. below the surface, "showing that the water of at least the upper 20 ft. was available to the trees."

On invitation, N. A. Cobb, of the Department of Agriculture of New South Wales, gave an interesting talk on his work in that country.

The following papers were read by title: Making a garden herbarium and its uses, by A. D. Selby; The making of a horticultural herbarium, by J. Burtt Davy; Laboratory work for winter instruction in horticulture, by E. S. Goff; Horticultural field work for classes, by A. B. McKay.

SECTION ON MECHANIC ARTS.

Most of the papers presented before this section dealt with the subject of courses, methods of instruction, and laboratory work. The practical importance of industrials was the subject of a paper by W. F. Gilkison, which brought out considerable discussion. The author advocated abolishing the present exercise system in shopwork and substituting in its place the making of articles or appliances of some use.

A paper by C. L. Cory, on The electrical engineering laboratory in its relation to local engineering work, was a suggestive one and led to considerable discussion.

J. T. Faig read a paper on The teaching of machine drawing, and G. Gwinner treated the general subject of Teaching methods.

Some objections to early differentiation of engineering courses were presented by J. C. Nagle in a paper bearing that title.

W. T. Magruder introduced The agricultural engineer—the latest developed specialist.

SECTION ON COLLEGE WORK.

Neither the chairman nor the secretary of this section was present. The papers by C. E. Coates on The principles underlying the formation of an agricultural course in the South, and by W. M. Liggett on Agricultural education, practical and scientific, which were noted above as having been read in the general session of the convention, were presented before this section. In addition W. J. Spillman discussed the subject of The short dairy course, and J. H. Raymond, University extension in agriculture.

EXCURSIONS.

The day following the adjournment of the convention (Saturday) was occupied in a trip to Golden Gate Park and the Cliff House in the forenoon, and to the experiment station at Berkeley in the afternoon. The week following was devoted to excursions to different parts of the State where typical features could be studied. Special trains were provided for the party, and the long distances were traversed by night. On Monday the excursion was to Santa Rosa and Ukiah, on the California and Northwestern Railroad, stopping at the vineyards and winery of an Italian Swiss agricultural colony at Asti on the return trip, and reaching San Rafael in time for a banquet in the evening. The following day was spent in the vicinity of Fresno, in the San Joaquin Valley, where extensive vineyards, orchards, wineries, an ice plant, a raisin-packing establishment, and a number of beautiful estates were visited. An object lesson in irrigation was here presented, and an admirable illustration given of up-to-date farming in the extensive estate of Minnewawa, owned and superintended by Miss Eshleman. While a diversity of agricultural interests were represented on this estate, the dairy feature especially commanded admiration.

Wednesday morning the party reached Oroville, in the Sacramento Valley, where orchards of oranges, figs, and other fruits were visited. Later in the day stops were made at Yuba City and Woodland, where teams were in waiting to drive the visitors through the orchards and grain fields in the vicinity. Antioch, on Suisun Bay, was reached early Thursday morning, and the day was spent on the San Joaquin River, visiting grain and truck farms at several points along the river. An opportunity was afforded to see the large traction steam reapers and thrashers in operation in the fields.

Returning to San Francisco Thursday night, a fresh start was made Friday morning down through the beautiful Santa Clara Valley. A stop was made at Palo Alto, where Stanford University and the breeding stables were viewed. From San Jose trips were taken through orchards of olives, prunes, and other fruits, an oil mill where strictly pure olive oil is prepared, and a large fruit cannery. The Morse seed farm, one of the largest in the country, and operated entirely by Chinamen, was visited late in the afternoon; after which the party proceeded to Monterey.

Saturday morning a drive of some 16 miles was taken along the coast, which was greatly enjoyed; and later in the day a visit was made to the great beet-sugar factory at Salinas, which, when completed, will be the largest factory of the kind in the world.

The party then returned to San Francisco, arriving there Saturday evening. This completed the itinerary of an extremely interesting and enjoyable series of excursions, which will long be remembered with pleasure by all who participated in them and shared the bounteous hospitality everywhere extended.

RECENT WORK IN AGRICULTURAL SCIENCE.

CHEMISTRY.

Chemical analysis of rocks—determination of potassium and sodium, E. Bonjean (*Bul. Soc. Chim. Paris, 3. ser., 22 (1899), No. 14, pp. 691–693*).—Silica, iron oxid, alumina, lime, magnesia, and sulphuric acid are determined by means of fusion with alkaline carbonates. For the determination of potassium and sodium the material is fused with calcium carbonate (0.5 gm. of the carbonate to 1 gm. of the rock). The silica, iron oxid, alumina, and lime are eliminated by the ordinary methods. The solution, freed from these substances, is evaporated to dryness on a water bath and ignited to remove ammonium salts. The residue is taken up in water and magnesia precipitated as ammonium-magnesium phosphate. Ammonia is driven off and the ammonium phosphate precipitated by means of a 10 per cent solution of fresh neutral lead acetate added in slight excess. The excess of lead is removed by means of hydrogen sulphid. The filtrate from the lead precipitate is evaporated to dryness, ignited at a low red heat, taken up in water, acidulated with hydrochloric acid, and the potassium determined in the usual way, except that the platinum is precipitated by means of magnesium. The filtrate from the potassium-platinum chlorid is evaporated to remove the alcoholic ether, platinum precipitated with hydrogen sulphid, filtered, the filtrate evaporated to dryness, and the residue ignited at a red heat after the addition of sulphuric acid. The sodium is weighed as sulphate.

New process for the rapid determination of starch, M. D. Crispo (*Rev. Chim. Analyt. et Appl., 4 (1899), No. 9, pp. 289, 290*).—The author reviews the methods that have been proposed for the determination of starch, and states that none are suitable for rapid commercial work. He offers the following method: Treat 3.391 gm. of substance in a mortar with a little water, and then transfer to a 200 cc. flask, add 50 cc. of potash solution (6 gm. per 100), and heat the material (150 cc. volume) for an hour on the water bath. The solution is filtered, and, if necessary, refiltered, using an ordinary plaited filter, and then polarized. The result of polarimetric examination (with a 20 cm. tube) multiplied by 6 gives percentage of anhydrous starch. It is claimed that the potash completely dissolves the starch and that the solution is stable. The author states that this new process has not been given a thorough trial for the determination of the starch in cereals, but presumes that the gluten and other nitrogenous bodies will combine with the potash to produce products which are optically active. Among the results given are corn as containing 85.45 per cent of starch, and rye, 85.05 per cent.—H. SNYDER.

The determination of the digestible protein and the albuminoids of foods and feeding stuffs, B. SJOLLEMA (*Ztschr. Untersuch. Nahr. u. Genussmtl., 2 (1899), No. 5, pp. 413–417*).—The author compared the use of commercial pepsin with that prepared from the stomach of swine according to Stutzer's method. The pepsin method used was as follows: Two grams of substance was digested for 48 hours in a water bath at 38 to 40° C. with 430 cc. of water, 1 gm. of pepsin, and 16 cc. of 10 per cent hydrochloric acid, adding 11 cc. of fresh acid at three different stages.

This was tested on a variety of feeding stuffs, and found to agree very satisfactorily with results from the use of the preparation from swine's stomach, indicating that commercial pepsin can be used in place of the latter.

In the determination of albuminoids in feeding stuffs like linseed cake, 1 gm. of substance was boiled with 50 cc. of water, and 50 cc. of 95 per cent alcohol added, then 50 cc. of cold water, 2 drops of cold saturated alum solution, and the prescribed amount of copper hydrate. Otherwise Stutzer's method was followed. The alcohol made the solution less slimy and more easily filtered. Trials with a number of different materials showed the modification to give the same results as the original Stutzer method for true albuminoids.

Detection of formaldehyde in milk, A. LEYS (*Jour. Pharm. et Chim., 6. ser., 10 (1899), p. 108; abs. in Chem. Ztg., 23 (1899), No. 66, Repert., p. 246*).—A colorless solution of phloroglucin (1 gm. in 1 liter), and potash solution (one-third "ordinary" strength) are used. A red color is produced if formaldehyde is present when 25 cc. of milk, 10 cc. of the phloroglucin solution, and 5 to 10 cc. of the potash are shaken in a test tube, the color disappearing after a few minutes. The Denigès test (E. S. R., 8, p. 459) is also recommended. Samples which give the reactions are distilled and the Denigès test applied again to make certain.

Recent progress in the field of agricultural chemistry, W. BERSCH (*Oesterr. Chem. Ztg., 11 (1899), No. 19, pp. 498–502*).—Recent articles relating to fertilizers, feeding stuffs, and soils are briefly reviewed.

Chemistry of soils and fertilizers, H. SNYDER (*Easton, Pa.: Chemical Publishing Co., 1899, pp. 277, pl. 1, figs. 35*).—The aim of this book is stated to be "to give, in condensed form, the principles of chemistry which have a bearing upon the conservation of soil fertility and the economic use of manures." It contains chapters on physical properties of soils; geological formation and classification of soils; chemical composition of soils; nitrogen of the soil and air; nitrification and nitrogenous manures; fixation; farm manures; phosphate fertilizers; potash fertilizers; lime and miscellaneous fertilizers; commercial fertilizers; food requirements of crops; and rotation of crops. Lists of problems, references, experiments, and review questions are also given. The book includes the results of recent investigations.

Investigations on Thomas slag, A. D. HERZFELDER (*Landw. Vers. Stat., 52 (1899), No 4, pp. 291–314*).—From the experiments reported the author concludes that it is tricalcium phosphate in Thomas slag which is soluble in citrate solution. The accuracy of the Wagner method is discussed.

The constitution of the ammonium-magnesium phosphate of analysis, F. A. GOOCH and M. AUSTIN (*Chem. News, 79 (1899), Nos. 2060, p. 233; 2061, pp. 244–246; 2062, pp. 255, 256*).—See E. S. R., 11, p. 107.

The mechanical precipitation of ammonium phosphomolybdate, F. WARSAGE (*Bul. Assoc. Belge Chim., 16 (1899), No. 7, pp. 343–345*).—A brief statement is made of the difficulties encountered when ammonium phosphomolybdate is precipitated. The author states that a complete precipitation can be secured in the cold by agitating the solution for 20 minutes. Brief directions are given for the preparation of the solution and the precipitation, and a table is appended showing the results secured by the new method (cold precipitation) and the old method (hot precipitation).—H. SNYDER.

Comparison of methods for detection of nitrates in water, L. GOBLET (*Bul. Assoc. Belge Chim., 16 (1899), No. 7, pp. 345–347*).—The author finds that Riegler's reaction (metadiamidobenzol and sulphuric acid) is the most sensitive; the presence of 0.000005 gm. of potassium nitrate in 10 cc. of water was capable of being detected.—H. SNYDER.

Gravimetric determination of sugar, G. MEILLÈRE and P. CHAPELLE (*Bul. Soc. Chim. Paris, 3. ser., 21–22 (1899), No. 10, p. 515*).—The reduction of the Fehling solution is carried out in a centrifugal tube. After heating in a concentrated salt bath the solution is whirled in the centrifuge, the clear liquid decanted, and the operation repeated twice with the addition of boiling water. The tube is heated at 150° C. for 5 minutes, cooled, and weighed.

A new "exact" method for determining fat in milk, A. A. BONNEMA (*Chem. Ztg., 23 (1899), No. 51, pp. 541, 542*).—The milk (10 cc.) is shaken in a "medicine bottle" with 1½ cc. of potash solution and then with 25 cc. of ether, cooled in water, and 2 gm. of tragacanth added, with vigorous shaking. The tragacanth takes up the water and forms itself into a ball. After cooling again, 10 cc. of the ether is poured off and evaporated, the fat weighed, and the percentage of fat in the milk calculated, taking the specific gravity into account.

A new method of estimating glycogen, E. PFLÜGER and J. NERKING (*Arch. Physiol. [Pflüger], 76 (1899), No. 11–12, pp. 531–542*).

Remarks on the article "A new method of estimating glycogen," E. PFLÜGER (*Arch. Physiol. [Pflüger], 76 (1899), No. 11–12, pp. 543–551*).

The quantitative determination of formaldehyde with peroxid of hydrogen, O. BLANK and H. FINKENBEINER (*Ber. Deut. Chem. Gesell., 32 (1899), No. 13, pp. 2142–2146*).

Detection of salicylic acid and boric acid in milk, G. BREUSTEDT (*Arch. Pharm., 237 (1899), No. 3, p. 170; abs. in Chem. Ztg., 23 (1899), No. 42, Repert., p. 158*).—A description of methods.

Direct measurement of the osmotic pressure of very dilute solutions of sodium chlorid, A. PONSOT (*Compt. Rend. Acad. Sci. Paris, 128 (1899), No. 24, pp. 1447, 1448*).

A simple apparatus for use in the Kjeldahl method for nitrogen, F. PREGL (*Ztschr. Analyt. Chem., 38 (1899), No. 3, pp. 166, 167, fig. 1*).—An automatic mercury vent is used in the distilling flask, which is said to remove all danger from frothing and to do away with the necessity for a safety bulb of any kind to prevent the acid going over.

An electrical apparatus for the determination of the melting point of fats and waxes, N. CHERCHEFFSKY (*Chem. Ztg., 23 (1899), No. 57, p. 597, fig. 1*).—A German silver tube with proper electrical insulation from its metal support is made one of the terminals of a circuit, while a cup of mercury on a sand bath is made the other. The tip of the tube is coated with some of the melted fat or wax to be tested, and the tube is placed in the mercury and heated. When the film of wax melts, the electrical circuit is completed, the fact being announced by an enunciator. A thermometer shows the temperature of the mercury.—J. T. ANDERSON.

A new thermoregulator for electrically heated thermostats, E. PRIOR (*Ztschr. Untersuch. Nahr. u. Genussmtl., 2 (1899), No. 9, pp. 701–703, fig. 1*).

Incandescent electric lamp as a source of heat in ether extraction, C. G. HOPKINS (*Jour. Amer. Chem. Soc., 21 (1899), No. 8, pp. 645–647, pl. 1*).—A battery of 20 extractors is illustrated, which are heated by five 110-volt electric lamps of 32-candlepower. The lamps are placed in a flat air bath, upon the top of which rest the ether flasks connected with the extractors.

A new "quartz-scale" polariscope, H. L. SAMSON (*Beet Sugar Gaz., 1 (1899), No. 7, pp. 8–10, figs. 3*).

A new low-pressure water-blast lamp, S. EPSTEIN (*Oesterr. Chem. Ztg., 2 (1899), No. 19, pp. 497, 498, fig. 1*).

BOTANY.

Native agricultural grasses of Kansas, A. S. HITCHCOCK and G. L. CLOTHIER (*Kansas Sta. Bul. 87, pp. 29, figs. 21, maps 29*).—The authors describe 29 species of the more important grasses, all of which are perennial except one, *Panicum crus-galli*. All of these are of sufficient importance to be included among the agricultural grasses of the State. The grass regions are divided into eight divisions, and the characteristic grasses of each given. These regions are wooded regions; sloughs, swales, and wet meadows; bottom land; prairies of eastern Kansas; upland plains of western Kansas; sandy regions; stony hills, and salt plains and alkali spots. The different species of grasses are figured and briefly described, and their distribution throughout the State, so far as represented by herbarium specimens in the station collection, are platted. Notes are also given on the relative economic value of the species.

Observations on the growth of plants in sunlight and in shade, BERTHELOT (*Compt. Rend. Acad. Sci. Paris, 128 (1899), No. 3, pp. 139–144*).—The author gives the results of some investigations made upon crested dogtail grass (*Cynosurus cristatus*), in which the differences observed in plants grown in the shade and in sunlight are shown. One lot of plants which had grown in natural meadow conditions exposed to the sun was harvested May 28. Another lot, cut at the same time, had grown under similar conditions except that it was continually under the shade of an elm tree; and a third lot, which was the aftermath from a previous cutting on June 3, was grown in the sun and cut on August 6. The average weight of the different lots is given, as well as the dry matter. Analyses are quoted in which the proportionate amounts of roots, stems, and leaves are shown, and also analyses in which the ash and some of the organic constituents are given.

Plants grown in the sun contain the maximum amount of carbon, that of the aftermath being somewhat less than in the first cutting. Phosphorus and sulphur are found most abundant in plants grown in the shade. The nitrogen content in each of the three cases was almost the same. Plants grown in the shade often appear more vigorous than others, but it is said to be due to the suppression or retardation of the functions of reproduction.

Modification of the respiration of plants by alternation of temperature, W. PALLADIN (*Compt. Rend. Acad. Sci. Paris, 128 (1899), No. 23, pp. 1410, 1411*).—The general law that the amount of carbon dioxid given off by plants increases in proportion to the temperature has been investigated, and the author finds that within certain limits it holds good. His experiments further show that intensity of respiration may vary considerably at any given temperature, providing the plants have some time previous to the beginning of the experiment been subjected to different extreme temperatures.

Experiments with etiolated stems of *Vicia faba* are reported, in which the extremities of the plants were cut off and placed in 10 per cent solutions of saccharose. One lot of these was exposed to a temperature of 17 to 20° C., a second to a low temperature ranging from 7 to 12°, and a third to a high temperature of 36 to 37.5° C. After several days the three lots were subjected to an average temperature of 18 to 22° and their respiration simultaneously determined. It was found that the amount of carbon dioxid given off by the plants which had been kept at the medium temperature was the lowest. Those subjected to the low temperature showed an increase of 40 per cent, and those which had received a high temperature in a previous part of the experiment gave off 53 per cent more carbon dioxid than those at the medium temperature. The cause of this phenomenon the author does not attempt to explain.

Anatomical and physiological characteristics of alpine plants produced by the alternation of extreme temperatures, G. BONNIER (*Compt. Rend. Acad. Sci. Paris, 128 (1899), No. 19, pp. 1143–1146*).—In a previous article (E. S. R., 10, p. 608) the author showed the possibility of producing alpine forms of plants by a day and night alternation in temperature. At that time the plants had not developed sufficiently to complete the study.

In the present paper he compares the anatomy and physiology of the germander plants in his experiments. It appears that the plants which resulted in the alternation of temperature were comparable in every way to those produced in high mountain regions. The stems and petioles of the leaves had their protective tissues more differentiated and were more rapidly developed. The leaves were smaller and much thicker, their palisade tissue much more developed, and they very frequently exhibited a red coloration due to anthrocyanin, which is quite frequently produced in alpine plants. The carbon dioxid assimilation was considerably in excess in plants grown under these conditions. The flowers produced were relatively larger and much higher colored.

Vernal phenomena in the arid region, T. D. A. COCKERELL (*Amer. Nat., 33 (1899), No. 385, pp. 39–43*).—The author reviews the theory relative to life zones as laid down by C. Hart Merriam, in which it is stated that the "northward distribution of terrestrial animals and plants is governed by the sum of the positive temperatures for the entire season of growth and reproduction and the southward distribution is governed by the mean temperature of a brief period during the hottest part of the year." The author states that the mean temperatures, even in January and February, are high enough to stimulate growth in those plants which have been introduced from more humid regions, but the native vegetation remains backward nothwithstanding the warmth. He gives tables to show the date of blooming of quite a number of peach, plum, and apricot trees, as well as of a considerable number of native plants.

It appears that with one or two exceptions native vegetation is backward notwithstanding the warm weather, but after the period of the latest killing frosts is passed it comes out with remarkable rapidity. At Mesilla Park the domestic honeybee is frequently seen in January, while the native bees seldom appear until late in March. The author states in conclusion that—

> "Throughout the arid region where the sky is clear and radiation great the development of plants and insects is controlled largely by the distribution of the frosts throughout the year. The climate of this region is peculiar and presents a barrier to the ingress of plants and animals from without. For tropical and subtropical species the winters are too cold. For species of moist temperate regions the late frosts following warm spells are usually destructive. It is a curious anomaly that in a locality having more than tropical summer temperatures plants of the temperate zone should fail on account of frosts.'

Notes on the maximum thermal death point of Sporotrichum globuliferum, B. M. DUGGAR (*Bot. Gaz., 27 (1899), No. 2, pp. 131–136*).—While engaged in a study of an entomogenous fungus, *Sporotrichum globuliferum*, experiments were made for the determination of the maximum thermal death point of this fungus under varying conditions. Cultures were made on nutrient agar in slanting tubes. When exposed for 24 hours at temperatures of 35°, 37.7°, and 40.5° C. the spores were effectually inhibited in growth. On the other hand, a few hours after germination had begun they were able to withstand considerably longer exposure to these temperatures. Three hours' exposure to temperatures of 46.1° and 51.6° was sufficient to destroy nearly all growth of the spores. The mycelium in the agar tubes was submitted for various lengths of time, ranging from 1 to 24 hours, at temperatures from 37.7 to 51.6°, in which it appears that the mycelium is quite resistant except to the higher temperatures and longer exposures.

Spores exposed to dry heat for from 1 to 6 hours at temperatures from 46.1 to 60° C. were in no wise injured. The maximum amount of dry heat which the spores of this fungus will resist during a single exposure was not ascertained. When exposed for 3 hours to a temperature of 51.6° on 4 successive days no growth resulted. Mycelium cultures on insects which were exposed from 1 to 24 hours at temperatures of 46.1° and 56.1° were affected but slightly, if at all.

Improvement of plants by selection, H. J. Webber (*U. S. Dept. Agr. Yearbook 1898, pp. 355–376, pls. 2, figs. 2*).—The object of this paper is to discuss the fixation of desirable variation by methodical selection and the gradual improvement of plants resulting from the cumulative effect of selecting through many generations. The methods of selection are discussed at some length and results as illustrated by the improvement of sea-island and other cottons shown. Some of the limitations of selection are pointed out and statements given relative to the development of new races by selection, as has been done in the case of the wild parsnip, *Anthriscus sylvestris*, and other plants. Notes are given on the improvement by selection of cuttings, slips, buds, etc., and illustrations drawn from work conducted by members of the Division of Vegetable Physiology and Pathology on violets are given.

A synopsis of the genus Sitanion, J. G. Smith (*U. S. Dept. Agr., Division of Agrostology Bul. 18, pp. 21, pls. 4*).—An attempt has been made to characterize the numerous forms that have generally been grouped under *Sitanion hystrix* or *Elymus sitanion*. In this synopsis 23 species, most of them new, are recognized and described.

Sand-binding grasses, F. Lamson-Scribner (*U. S. Dept. Agr. Yearbook 1898, pp. 405–420, pls. 3, figs. 9*).—The author describes some of the principal grasses which are distinctively sand binders, both those growing near the seashore and those which are natives of the interior. Among those best adapted to this purpose are the beech or the marram grass, sea lyme grass, bitter panic grass, creeping panic grass, seaside blue grass (*Poa macrantha*), Redfield's grass (*Redfieldia flexuosa*), sand grass (*Calamovilfa longifolia*), yellow lyme grass, and sand blue grass (*Poa leckenbyi*). Other grasses which are not true sand binders but will grow in sandy situations are Johnson grass, *Arundo donax*, some of the bamboos, and wheat grasses.

Forage plants for cultivation on alkali soils, J. G. Smith (*U. S. Dept. Agr. Yearbook 1898, pp. 535–550, figs. 4*).—The author states the effect of alkalis on plant growth, quoting extensively from Wyoming Station Bulletin 29 (E. S. R., 8, p. 568) and California Station Bulletin 105 (E. S. R., 7, p. 717).

Descriptions are given of various saltbushes native to Australia which have proved more or less valuable for forage on alkali soils. In addition to the Australian species, a number of indigenous saltbushes are described. Notes are given on other plants of somewhat similar character.

Production of Johnson grass for forage, T. A. Williams (*Breeders' Gaz., 35 (1899), No. 26, pp. 775, 776*).—This grass is highly recommended for a hay grass, being more esteemed for that purpose than for pasture. On account of the habit of growth it should not be used in any rotation.

Corn plants, F. L. Sargent (*Boston: Houghton, Mifflin & Co., 1899, pp. V+106, figs. 32*).—An untechnical work designed to be supplemental to the use of text-books in secondary schools. It gives in considerable detail the life histories of the different cereals and suggests the part each has had in the world's economy.

Contributions to the knowledge of Mortierella van tieghemi, H. Bachmann (*Ber. Schweiz. Bot. Gesell., 1899, No. 9, p. 36*).

The structure of the caryopsis of grasses with reference to their morphology and classification, P. B. Kennedy (*U. S. Dept. Agr., Division of Agrostology Bul. 19, pp. 44, pls. 8*).—An historical review and summary of the previous investigations on this subject is given, together with a general description of the fruit, in which the various parts are described. Detailed descriptions are given of the fruits of the different grasses, representatives being given of each of the 13 tribes recognized by Hackel in his arrangement of the grasses. The relationship and systematic connection of the tribes are discussed and a bibliography of the subject appended.

Concerning the anatomy of water-secreting organs, M. VON MINDEN (*Stuttgart, 1899, pp. 76, pls. 7; abs. in Bot. Ztg., 2. Abt., 57 (1899), No. 20, pp. 308, 309*).

The physiological characteristics of the cell, F. SCHENCK (*Physiologische Charakteristik der Zelle. Würzburg: A. Stuber, 1899, pp. VIII + 123*).

The influence of inorganic salts upon the formation of conidia by Aspergillus niger, A. YASUDA (*Bot. Mag. [Tokyo], 13 (1899), pp. 85–91*).

A preliminary note as to the cause of root pressure, R. G. LEAVITT (*Amer. Jour. Sci., 4. ser., 7 (1899), No. 41, pp. 381, 382*).—An attempt is made to explain, by Van't Hoff's interpretation of osmotic pressures, some of the hitherto poorly understood phenomena, such as the increased absorption due to heat as shown by the experiments of Sachs, variation in tree pressures noted by Clark, etc.

A preliminary arrangement of the species of the genus Bacillus, F. D. CHESTER (*Delaware Sta. Rpt. 1898, pp. 100–137*).—The author gives an arrangement of the species of the genus Bacillus following the table of characters and abbreviations used in a previous memoir on the genus Bacterium (E. S. R., 10, p. 519). In all 143 species are described at more or less length and an index to the more important literature of the species is appended.

Edible and poisonous fungi of Middle Europe, G. BRESADOLA (*I funghi mangerecci e velenosi dell' Europa media, etc. Milan: U. Hoepli, 1899, pp. 152, pls. 112*).

Fungi in greenhouses, H. WEBSTER (*Rhodora, 1 (1899), No. 5, pp. 83, 84*).—Notes on some fleshy fungi in greenhouses.

Alinit, the new soil bacteria, B. DURFEE (*Amer. Florist, 14 (1899), No. 580, pp. 1453, 1454*).—Notes the use of Alinit in floriculture. Experiments with asters and carnations are reported. The test with asters was a complete failure, while some advantage to one pot of carnations is reported. On the other plants no effect of inoculation was apparent.

Experiments with Nitragin, R. T. HENNINGS (*K. Landt. Akad. Handl., 38 (1899), No. 1, pp. 14–21*).—No effect or only slight effects were obtained in two different experiments with peas.

Concerning the results obtained by Nitragin inoculation, FRANK (*Landw. Vers. Stat., 51 (1899), No. 6, pp. 441–445*).—The author sums up for the Prussian Ministry of Agriculture the evidence relative to the use of Nitragin as a means of inoculating leguminous crops. Under certain circumstances the substance may be used with advantage, but in many experiments negative results are reported. In soils poor in nitrogen and in which no organisms capable of nitrogen assimilation are present favorable results are likely to follow, but where nitrogen and organisms are plentiful its use is not recommended.

The bacteria of the soil with special reference to soil inoculation, R. S. MACDOUGALL (*Trans. and Proc. Bot. Soc. Edinburgh, 21 (1897), pt. 1, pp. 25–40*).—Gives an account of pot experiments with Nitragin cultures in sterilized soil in which the advantage of using the proper kind of cultures for each crop is shown. Notes are also given on nitrifying organisms and their action.

The influence of organic substances upon the work of nitrifying organisms, S. WINOGRADSKY and V. OMELIANSKY (*Centbl. Bakt. u. Par., 2. Abt., 5 (1899), Nos. 10, pp. 329–343; 11, pp. 377–387; 12, pp. 429–440*).

Bud variation, L. BEISSNER (*Seperat. Niederrhein. Ges. Nat. u. Heilkunde, Bonn, 1898, pp. 30–42; abs. in Jour. Roy. Micros. Soc. [London], 1899, No. 3, pp. 295, 296*).—The author enumerates the various kinds of bud variation which occur especially in woody plants, resulting in pyramidal or columnar forms, pendent and weeping forms, dwarf forms, forms of deeply divided or highly colored leaves, etc. The danger of confusing the variations which result from unfavorable or other vital conditions with true bud variations is pointed out, and the limited knowledge of the conditions which determine bud variation is commented upon.

Bud variation in plants, R. M. KELLOGG (*Proc. Michigan Hort. Soc., 1897, pp. 121–134*).—The principal causes of bud variation are pointed out and several specific cases are cited.

The causes of variation in cultivated plants which give us new varieties, H. AYERS (*Missouri Hort. Soc. Rpt., 1898, pp. 21-35*).—A popular presentation of the subject.

A study of the methods of seed dispersal, K. SAJO (*Prometheus, 10 (1899), No. 499, pp. 481-485, fig. 1*).—Comparative studies are given between the seed of *Pinus austriaca* and *P. sylvestris.*

ZOOLOGY.

Birds as weed destroyers, S. D. JUDD (*U. S. Dept. Agr. Yearbook 1898, pp. 221-232, figs. 7*).—The most important weeds which are prevented by birds from seeding are ragweed, pigeon grass, smartweed, bindweed, crab grass, lamb's-quarters, and pigweed. Birds are most actively engaged in feeding upon weed seeds during the winter months. The birds which are most effective in this work are about 20 species of sparrows and finches, horned larks, blackbirds, cowbirds, meadow larks, doves, and quails. The English sparrow is reported as especially useful in destroying the seeds of crab grass and dandelion. Three-fourths of the dandelions which bloom on the Department lawns during April and May are said to be mutilated by birds. The native sparrows are active in this destruction of the dandelion.

The common goldfinch is praised as an unusually valuable bird in this particular work. Horned larks are said to feed to a considerable extent upon sorrel. The blackbirds are found to eat large quantities of the seeds of wild sunflowers, sorrel, mustard, chickweed, and thistle during the fall. The quail and mourning dove are also noted as weed destroyers. In the crop of one mourning dove were found 7,500 seeds of *Oxalis stricta.* About 50 species of birds are noted as destroyers of somewhat more than 60 species of weeds.

Manitoba birds of prey and the small mammals destroyed by them, G. E. ATKINSON (*Trans. Hist. and Sci. Soc. Manitoba, 1898, No. 53, pp. 16, figs. 7*).—This paper treats of the feeding habits of the Cathartidæ, Falconidæ, and Strigidæ, with special reference to the Manitoba species of these families. Nearly all the species considered are believed to be more beneficial than injurious, and some of them are said to feed exclusively upon injurious species of animals. Of the mice and gophers which are most frequently found in the stomach of these birds, the author mentions *Arvicola riparius*, *A. gapperi*, *Spermophilus franklini*, *S. tridecimlineatus*, *S. richardsoni*, and *Thomomys talpoides.* Estimates are given of the number of mice per acre and the amount of damage done by mice and gophers.

The danger of introducing noxious animals and birds, T. S. PALMER (*U. S. Dept. Agr. Yearbook 1898, pp. 87-110, pl. 1, figs. 6*).—The author calls attention to the many cases of accidental and intentional introduction of mammals and birds into new countries. In most cases these animals when intentionally introduced were supposed to be distinctly beneficial in the destruction of injurious insects and other animals, but while the importations seemed to be successful at first, the imported animals have almost without exception proved to be in the end as bad pests as were those pests which they were intended to exterminate.

Brief descriptions are given of a number of these intentional importations, including such animals as the rabbit, mongoose, stoat, weasel, flying fox, English sparrow, starling, and mina, all of which animals proved decidedly injurious. Various attempts have been made to introduce into this country the skylark, green linnet, black thrush, and the great titmouse. Neither one of these latter named species has become very numerous in this country, but all are likely to prove injurious in case they should become abundant.

The author calls attention to various legislative restrictions which have been adopted in other countries against the importation of animals which may become injurious and urges that the time has come when the United States may well pass some general law of this sort.

Observations on the normal and pathological histology and bacteriology of the oyster, W. A. HERDMAN and R. BOYCE (*Proc. Roy. Soc. [London], 64 (1899), No. 407, pp. 239-241*).—This paper is an abstract of an extended account of the authors' investigations with oysters. A portion of the work was previously reported (E. S. R., 10, p. 522). The primary object of the investigation was to study the oyster under unhealthy conditions, but this rendered necessary much histological work. The principal conclusions concerning the greening of oysters and the possibility of infection through oysters follow:

> "A diseased condition we found in certain American oysters very soon brought us into contact with the vexed question of the 'greening' of oysters, and one of the first results we arrived at was that there are several distinct kinds of greenness in oysters. Some of them, such as the green Marennes oysters, and those of some rivers on the Essex coast, are healthy; while others, such as some Falmouth oysters, containing copper, and some American oysters rebedded on our coast, and which have the pale-green 'leucocytosis,' . . . are not in a healthy state.
>
> "Some forms of greenness (e. g., the leucocytosis) are certainly associated with the presence of a greatly increased amount of copper in the oyster, while other forms of greenness (e. g., that of the Marennes oysters) have no connection with copper, but depend upon the presence of a special pigment, 'marennin.'
>
> "We are able, in the main, to support Ray Lankester in his observations on Marennes oysters; but we regard the wandering amœboid granular cells on the surface of the gills as leucocytes which have escaped from the blood spaces, and have probably assumed a phagocytic function.
>
> "We see no reason to think that any iron which may be associated with the marennin in the gills, etc., is taken in through the surface epithelium of the gill and palps, but regard it, like the rest of the iron in the body, as a product of ordinary digestion and absorption in the alimentary canal and liver.
>
> "We do not find that there is any excessive amount of iron in the green Marennes oyster compared with the colorless oyster, nor do the green parts (gills, palp, etc.) of the Marennes oyster contain either absolutely or relatively to the colorless parts (mantle, etc.) more iron than colorless oysters. We therefore conclude that there is no connection between the green color of the 'Huîtres de Marennes' and the iron they may contain.
>
> "On the other hand, we do find by quantitative analysis that there is more copper in the green American oyster than in the colorless one; and more proportionately in

the greener parts than in those that are less green. We therefore conclude that their green color is due to copper. We also find a greater quantity of iron in those green American oysters than in the colorless; but this excess is, proportionately, considerably less than that of the copper.

"In the Falmouth oysters, containing an excessive amount of copper, we find that much of the copper is certainly mechanically attached to the surface of the body, and is in a form insoluble in water, probably as a basic carbonate. In addition to this, however, the Falmouth oyster may contain a much larger amount of copper in its tissues than does the normal colorless oyster. In these Falmouth oysters the cause of the green color may be the same as in the green American oyster.

"By treating sections of diseased American oysters under the microscope with potassium ferrocyanid and various other reagents, we find that the copper reactions correspond in distribution with the green coloration; and we find, moreover, from these micro-chemical observations that the copper is situated in the blood cells or leucocytes, which are greatly increased in number. This condition may be described as a green leucocytosis, in which copper in notable amount is stored up in the leucocytes.

"We find that an aqueous solution of pure hæmatoxylin is an extremely delicate test for copper, just as Macallum found it to be for iron.

"Experiments in feeding oysters with weak solutions of various copper and iron salts gave no definite results, certainly no clear evidence of any absorption of the metals accompanied by 'greening.'

"Although we did not find the *Bacillus typhosus* in any oysters obtained from the sea or from the markets, yet in our experimental oysters inoculated with typhoid we were able to recover the organism from the body of the oyster up to the tenth day. We show that the typhoid bacillus does not increase in the body or in the tissues of the oyster, and our figures indicate that the bacilli perish in the intestine.

"Our experiments showed that sea water was inimical to the growth of the typhoid bacilli. Although their presence was demonstrated in one case on the twenty-first day after addition to the water, still there appeared to be no initial or subsequent multiplication of the bacilli.

"In our experiments in washing infected oysters in a stream of clean sea water the results were definite and uniform; there was a great diminution or total disappearance of the typhoid bacilli in from 1 to 7 days.

"The colon group of bacilli is frequently found in shellfish as sold in towns, and especially in the oyster; but we have no evidence that it occurs in mollusca living in pure sea water. The natural inference that the presence of the colon bacillus invariably indicates sewage contamination must, however, not be considered established without further investigation. . . .

"We have shown also the frequent occurrence, in various shellfish from the shops, of anaërobic spore-bearing bacilli giving the characteristics of the *B. enteritidis sporogenes* recently described by Klein."

A text-book of agricultural zoology, F. V. THEOBALD (*Edinburgh and London: W. Blackwood & Sons, 1899, pp. XVII + 511, figs. 225*).—In this volume the author discusses the general principles of zoology and gives consideration to all the orders of the animal kingdom. Those orders which are of special economic importance are treated more fully than the groups which are not distinctly related to agriculture. Among the subjects treated may be mentioned the Ciliata which are found in the intestines of various domestic animals and man; the Sporozoa, sometimes parasitic in vertebrate animals; the various parasitic flat and round worms; and annelids. In the order Orthropoda, the author gives most attention to those insects, myriapods, and arachnida which are the enemies or friends of agriculture. In discussing the mammals the author gives a detailed account of the horse. In the appendix, lines of treatment are suggested for insect pests and for diseases caused by worms.

The fauna of Cuba, W. MARSHALL (*Die Thierwelt Cubas. Leipsic: C. E. M. Pfeffer, 1898, pp. 17; separate from Ztschr. Naturw., 71 (1899), pp. 219–236*).—The paper gives a general account of the native mammals, birds, reptiles, amphibians, fishes, mollusks, insects, and crustacea of the Island of Cuba. The author calls attention to the presence of large numbers of wild dogs, cats, horses, hogs, goats, and rabbits which are injurious to most cultivated crops and to poultry.

Natural history of the Tres Marias Islands, Mexico (*U. S. Dept. Agr., Division of Biological Survey, North American Fauna No 14, pp. 97, pl. 1, figs. 2*).—This bulletin contains the following items: General description, mammals, birds, and a partial bibliography of the Tres Marias Islands, E. W. Nelson; reptiles of the Tres Marias Islands, L. Stejneger; notes on the Crustacea of the Tres Marias Islands, Mary J. Rathbun; and plants of the Tres Marias Islands, J. M. Rose.

Results of a biological survey of Mount Shasta, California, C. H. MERRIAM (*U. S. Dept. Agr., Division of Biological Survey, North American Fauna No. 16, pp. 179, pls. 5, figs. 46*).—This bulletin contains an account of the itinerary of an expedition in the neighborhood of Mount Shasta, with a discussion of the general geographical features of the region, the forest conditions, the effects of forest fires and of slope exposure, and a study of the life zones found represented upon this mountain. Some observations are made upon the boreal fauna and flora of Shasta as compared with corresponding faunas and floras of the Sierra and Cascades. Annotated lists are given of the mammals, birds, and plants which were noted during the expedition.

The economic importance of some common birds, E. B. WILLIAMSON (*Jour. Columbus Hort. Soc., 13 (1898), pp. 33–44*).—The author discusses the feeding habits of a number of common birds of Ohio which may be considered beneficial to agriculture.

The relation of birds to horticulture, W. W. COOKE (*Colorado State Bd. Hort. Rpt. 1898, pp. 45–53*).—Popular notes on the feeding habits of some common birds.

Birds on the farm, H. H. HEATON (*Iowa State Agr. Soc. Rpt. 1898, pp. 458–461*).—The economic relationship of a number of common birds is discussed, including the house wren, the rose-breasted grosbeak, Baltimore oriole, tree sparrows, crows, woodpeckers, English sparrows, and the meadow lark. The tree sparrows were observed feeding voraciously upon various weed seeds.

Is the sparrow the friend or foe of the gardener and florist? W. N. CRAIG (*Amer. Florist, 14 (1899), No. 570, pp. 1204–1206*).—Relates the insect-eating habits of the English sparrow, and concludes that the benefits from this bird outweigh its injuries.

The woodpecker (*Bul. Bot. Dept. Jamaica, n. ser., 6 (1899), No. 4, p. 58*).—The woodpecker is reported as feeding on cocoa beans.

Observations on owls with particular regard to their feeding habits, T. H. MONTGOMERY (*Amer. Nat., 33 (1899), No. 391, pp. 563–572*).—Observations upon the short-eared owl (*Asio accipitrinus*) and the long-eared owl (*A. wilsonianus*).

Animals which are injurious to the sugar beet, with descriptions of their life habits and remedies for controlling them, W. MÜLLER (*Thierische Zuckerrüben-schädlinge, Beschreibung, Lebensweise und Vertilgung. Berlin: Paul Parey, 1893, pp. 90, figs. 42*).—This is a sort of handbook recording all the animal depredators of the sugar beet, including mammals, birds, insects of various orders, myriapods, and nematodes. Many of the insects which are treated are figured, as well as the myriapods and nematodes, and remedies are suggested in each case.

The extermination of rabbits by means of plate traps (*Deut. Landw. Presse, 26 (1899), No. 44, p. 498, fig. 1*).—A brief account of the use and effectiveness of this sort of trap.

Rabbit plague in vineyards of Stuttgart, J. HOFFMANN (*Jahreshefte Ver. Vaterl. Naturk. Württemberg, 55 (1899), pp. 425–431*).—Since 1896 numerous complaints have been made in this region concerning the destruction of beans, peas, and other garden plants, as well as young grapevines, by rabbits. Upon investigating the matter, it was found that the rabbits which were doing the damage were descendants of tame rabbits which had escaped and which had come to resemble in form, size, and color the ordinary wild rabbit. The soil in this particular locality was unfavorable for the digging of burrows, and as a result the rabbits had made short burrows, especially under rubbish or stones.

Gopher destruction (*Rpt. Dept. Agr. Northwest Territories, 1898, pp. 36–38*).—A brief discussion of the use of strychnin and bisulphid of carbon as remedies against these animals.

Revision of the jumping mice of the genus Zapus, E. A. PREBLE (*U. S. Dept. Agr., Division of Biological Survey, North American Fauna No. 15, pp. 39, pl. 1, figs. 4*).—This bulletin contains a brief history of our knowledge of the genus Zapus and a monographic account of the genus, including one Asiatic species. The species of the genus, except the one, belong to North America. Notes are given in connection with each species on the habits of the animals.

Observations on the common toad, G. L. ROPE (*Zoologist, 4. ser., 3 (1899), No. 27, pp. 97–102*).—Gives the habits of *Bufo vulgaris*.

The classification of Tæniidæ, A. RAILLIET (*Centbl. Bakt. u. Par., 1. Abt., 26 (1899), No. 1, pp. 32–34*).—This paper contains a discussion of the relationship of the genera of this family.

A contribution to the knowledge of earthworms, W. MICHAELSEN (*Zool. Jahrb., Abt. Syst., 12 (1899), No. 2, pp. 105–144, figs. 2*).—A general account of the habits and life history, with descriptions of new species.

Earthworms, M. C. HOLMES (*Sci. Amer. Sup., 47 (1899), No. 1228, pp. 19601, 19602, figs. 3*).—Anatomical and physiological observations on earthworms, with notes on their habits and biological relations.

The beet-root worm (*Pop. Sci., 33 (1899), No. 5, p. 102, figs. 6*).—Popular notes are given on *Heterodera schachtii*.

Nematode worms injurious to cereals, J. JABLONOWSKI (*Kisérletügyi Közlemények, 2 (1899), No. 4, pp. 169–197, figs. 10*).—This article contains a detailed description of the habits and methods of attack of *Tylenchus devastator* and *T. scandens*. Among the remedies which are recommended by the author may be mentioned deep plowing and soaking the seed grain in a ¾ per cent solution of blue vitriol and water for 24 hours.

METEOROLOGY.

Monthly Weather Review (*U. S. Dept. Agr., Weather Bureau, Monthly Weather Review, 27 (1899), Nos. 4, pp. 139–186, figs. 3, charts 11; 5, pp. 187–241, pls. 6, figs. 9, charts 8; 6, pp. 243–285, charts 9*).—In addition to the usual reports on forecasts and warnings and on weather and crop conditions, and meteorological tables and charts, No. 4 contains special contributions on Sun spots and Hawaiian eruptions, by C. J. Lyons; A talk on elementary meteorology (illus.), by G. M. Davison; Long-range weather forecasting in Canada, by J. Gun; Climate and crop service publications, by J. Berry; Normal precipitation in the region of the Great Lakes, by A. J. Henry; and Text-books on botany, by F. V. Coville; and notes by the editor on pamperos and cyclonic storms, spool kites and kites with radial wings (illus.), newspaper fakes, universities and meteorology, ball lightning, empirical generalizations for South Carolina, radiant heat for the prevention of frost, the present state of long-range forecasting, characteristics of tornadoes, death of Mariano Bárcena, no increase in tornadoes, no change in the climate of April, rains of sand, dust, and mud, the prediction of tornadoes and thunderstorms, international courtesy, recent earthquakes, National Geographic Society, the weather service of Jamaica, West Indies, and daily international exchange with Mexico.

No. 5 contains special contributions on Monthly reports of the Weather Bureau service in the West Indies, by W. B. Stockman; The utilization of fog, by F. A. Carpenter; The flood of January, 1880, at Basseterre, St. Kitts, West Indies, by W. H. Alexander; Derecho, not tornado, of May 16 in Ohio, by J. W. Smith; Balloon ascensions on March 24, 1899, in France, by F. H. Bigelow; Climatology of the Isthmus of Panama, including the temperature, winds, barometric pressure, and precipitation (illus.), by H. J. Abbot; Spurious tornado photographs, by A. J. Henry; The meteorological service of Canada, by R. F. Stupart; An advance in measuring and photographing sounds (illus.), by E. F. Sharpe; and Rainfall and temperature in Nicaragua, by A. P. Davis; and notes by the editor on the Pacific Coast division of the Canadian meteorological service, "scientific aids" in the Department of Agriculture, and records by the Milne seismograph (illus.).

No. 6 contains special contributions on Extraordinary rainfall in Texas, by H. A. Hazen; Some physical features and flood conditions of the James River Valley, by E. A. Evans; Records by the kite corps at Bayonne, N. J., by H. L. Allen; and The precipitation over the Pacific Northwest and the possibility of high water in the Columbia from the melting snow in the mountains, by B. S. Pague; and notes by the editor on climatological data for Canada, the annual summaries of the climate and crop service, the climate adapted to tobacco, the duration of the growing season for 1898, ribbon lightning, unnecessary tornado alarms, the camphor barometer, an objectionable new meteorological term ["snow tornadoes"], Weather Bureau men as university lecturers, the conflict of man with the climate, widespread area of drought or cold, rainfall at high stations, physics and meteorology in the universities, and the climate and crop service in Puerto Rico.

Report of the meteorologist, W. H. BISHOP (*Delaware Sta. Rpt. 1898, pp. 247-262*).—Monthly summaries of observations at six different places in Delaware on temperature, pressure, precipitation, relative humidity, and prevailing winds during the year ended June 30, 1898, and a summary of observations on temperature and precipitation during the calendar year 1897 are given and the data are briefly discussed. The summary for 1897 is as follows:

Annual summary of meteorological observations in Delaware, 1897.

Locality.	Temperature.			Total rainfall.	No. days on which 0.01 in. or more of rain fell.
	Highest.	Lowest.	Mean.		
	Deg. F.	*Deg. F.*	*Deg. F.*	*Inches.*	
Newark	94 (Sept. 10, 11).	6.5 (Jan. 25)	52.6	43.99	[illegible]
Middletown	97 (Sept. 11)	6 (Jan. 26)	53.3	47.98	[illegible]
Dover	94 (June 30)	8 (Jan. 26)	53.7	43.43	124
Milford	97.5 (Sept. 11)	9.5 (Jan. 26)	56.2	46.62	416
Seaford	95.5 (Sept. 10)	8 (Jan. 26, 31)	55	44.59	110
Millsboro	94 (Sept. 11)	3 (Jan. 31)	54.2	50.14	130

Ninth annual report of the New York Weather Bureau, 1897 (*Rpt. New York State Dept. Agr., 5 (1897), II. pp. 1-424, charts 28*).—This report includes daily and monthly summaries of observations on temperature at some 103 stations in 54 counties of the State, on precipitation at 131 stations, and on atmospheric pressure at 10 stations, and a review of the crop conditions during the year. The meteorological conditions during 1897 are summarized as follows:

"The average atmospheric pressure (reduced to sea level and 32° F.) for the State of New York during 1897 was 30.05 in.; the highest monthly mean pressure, 30.15 in., occurring in September, and the lowest, 29.94 in., in July. The highest barometer was 30.87 in. at Albany on March 1, and the lowest was 29.06 in. at Oswego on November 9, giving a range of 1.81 in. within the State. The highest local monthly mean pressure was 30.18 in. at Albany in October, the lowest being 29.92 in. at Buffalo, Rochester, and Oswego in July. The greatest local range was 1.69 in. at Albany, and the least, 1.56 in., at Buffalo and Erie. The mean annual range for all stations was 1.63 in. The greatest departures of monthly means from the normal were +0.08 in. in April, September, and October, and —0.06 in May.

"The mean annual temperature for the State was 46.4°, as derived from the records of 81 stations; the mean temperature of January, the coldest month, being 22.3°, and of July, the warmest month, 72.1°. The highest local annual mean was 52.6° at Brooklyn, and the lowest was 40.7° at North Lake, Herkimer County. The highest local monthly mean was 75.1° at Canajoharie in July, and the lowest was 13.9° at Saranac Lake in January. The maximum temperature reported during the year was 102° at Avon on July 5 and 10, and the minimum was 28° below zero at Saranac Lake on February 28, giving an annual range of 130° within the State. The average daily range for the year was 19°; the greatest local value being 25° at Oxford, while the least was 12° at Arkwright. The mean annual temperature of the State, as derived from the records of 22 stations possessing records of 10 years or more, was very slightly above the normal. Only Honeymead Brook and Plattsburg Barracks reported deficiencies of temperature.

"The average total precipitation over the State for the year was 40.30 in., as derived from the records of 121 stations. The maximum local precipitation was 59.26 in. at Setauket, while the minimum was 19.85 in. at Mt. Morris. The greatest monthly average for the State was 6.88 in. in July, the least being 1.10 in. in March. The greatest local monthly precipitation was 18.18 in. at Setauket in July, and the least was 0.13 in. at Poughkeepsie in October. The total depth and distribution of precipitation over the State are shown in the fourth chart of this report, and the average daily amounts by the sixth chart. The average precipitation during 1897 at 27 stations possessing records for previous years was 1.49 in. above the normal amount. Deficiencies were reported from 12 stations, the greater number of which were located in western and central New York. The amounts exceeded any annual rainfall previously recorded at Honeymead Brook and Setauket, while at Cortland the rainfall was the least on record. The average total snow fall at 53 widely distributed stations was 59.9 in. The heaviest snow fall, exceeding 100 in., occurred on the highlands east of Lakes Ontario and Erie, the maximum local amount being 145 in. at North Lake. On the coast and in the central valleys the total depth ranged from 25 to 40 in.

"The average number of days on which the precipitation amounted to 0.01 in. or more was 127. The number was largest near the Great Lakes and over the Northern Plateau, and least in the southeast and near the Central Lakes.

"The average number of clear days for the State was 118, of partly cloudy days 113, and of cloudy days 134, giving an average cloudiness of 53 per cent."

New work in the Weather Bureau, W. L. MOORE (*U. S. Dept. Agr. Yearbook 1898, pp. 81–86*).—A brief account of the extension of the work of the Weather Bureau during 1898 along the following lines: Additional stations of observations in the arid and subarid West and in the principal cotton-producing regions of the

South; the establishing of 17 aerial meteorological stations; the inauguration of a tentative West Indian daily cablegraphic meteorological service.

Meteorological observations, J. E. Ostrander and A. C. Monahan (*Massachusetts Hatch Sta. Met. Buls. 127, 128, 129, pp. 4 each*).—These bulletins give the usual summaries of meteorological observations, with general notes on the weather during the months of July, August, and September, 1899.

Meteorological report, J. Dryden (*Utah Sta. Rpt. 1898, pp. XX, XXI*).—This is a monthly summary of observations on temperature and precipitation during 1891–1897. The mean temperature during 1897 was 46.5° F., the average for the 7 years being 46.4°. The precipitation during 1897 was 17.45 in., the average for the 7 years being 15.22 in.

The velocity and force of the wind (*Rev. Sci. Paris, 4. ser., 12 (1899), No. 14, p. 443*).—A brief reference to work of Köppen on this subject.

Cyclones, hurricanes, and tornadoes, F. H. Bigelow (*U. S. Dept. Agr. Yearbook 1898, pp. 525 534*).—A brief discussion of the origin and characteristics of these 3 classes of storms.

The terrestrial atmosphere, E. Tassilly (*L'Atmosphère terrestre. Paris: Société d'Éditions Scientifiques, 1899, pp. 110*).

The use of kites in the exploration of the upper air, C. F. Marvin (*U. S. Dept. Agr. Yearbook 1898, pp. 201–212, pl. 1, figs. 9*).—The standard kite and apparatus used by the Weather Bureau in explorations of the upper air are described and detailed directions for building and flying a tailless kite of modern type are given.

The kite as an instrument of meteorological research, C. F. Marvin (*Jour. Franklin Inst., 148 (1899), No. pp. 241–259, figs. 6*).

Diurnal variation in atmospheric electricity, A. B. Chauveau (*Compt. Rend. Acad. Sci. Paris, 129 (1899), No. 13, pp. 500, 501; abs. in Rev. Sci. Paris, 4. ser., 12 (1899), No. 15, p. 472*).

Investigations on the influence of forests on floods (*Centbl. Gesam. Forstw. Wien, 25 (1899), No. 10, pp. 434–437*).—A brief account is given of the action of a committee of the Association of Forestry Experiment Stations appointed to formulate plans for investigations on this subject. An outline plan of observations was adopted. This includes, in addition to the usual meteorological observations, measurements of the flow of streams and observations on precipitation, evaporation, soil moisture, drainage, and position of ground water.

WATER—SOILS.

Soil moisture, J. T. Willard and R. W. Clothier (*Kansas Sta. Bul. 89, pp. 22, charts 5*).—This is an account of experiments on soil moisture during 2 years in continuation or extension of previous experiments along the same line (E. S. R., 9, p. 138).

"The experiments described are of two types, those to test the effects of the addition of certain fertilizers to soils, with reference to soil moisture, and those to show the effects of tillage.

"Experiments with soil in pots, tried under the most rigid conditions available, showed that the rate of evaporation of water from soils is not sensibly affected by the addition to the soil of relatively large amounts of the substances ordinarily used as fertilizers, nor by certain others.

"Experiments with outdoor plats where both evaporation and drainage came into play, showed no decided effect from the fertilizers except with the plat to which unleached ashes were applied, which lost water more readily than any of the others."

The substances experimented with in pots included muriate of potash, salt, magnesium chlorid, sulphate of potash, kainit, carnallite, and superphosphate at the rate of 904 lbs. per acre, slaked lime at the rate of 12 bu. per acre, and barnyard manure at the rate of 28 tons per acre. In the plat experiments the substances used were muriate of potash, salt, magnesium chlorid, sulphate of potash, sodium nitrate, potassium nitrate, ammonium sulphate, superphosphate, and gypsum at the rate of 500 lbs. per acre, lime and wood ashes at the rate of 2,000 lbs. per acre, and manure and leaf mold at the rate of 40,000 lbs. per acre.

"Experiments to test the relative efficiency of different kinds of culture in conserving soil moisture showed that simple plowing while the soil was in good condition was as efficacious as plowing followed by planking, rolling, harrowing, or subsurface packing. Disking was found to be a good means of saving moisture, but was not equal to plowing.

"The importance of plowing stubble ground as early as possible while moisture is still in the soil was shown by experiments in 2 years. Early plowing left the ground in good condition, as regards soil moisture, for wheat seeding, while late-plowed ground was dangerously dry.

"The efficiency of the dry soil or dust mulch, and its superiority in the long run over a straw mulch, were strikingly shown."

In these experiments it was found that a sampling tube cutting a one-inch core was much less likely to choke and gave more accurate samples than one having a smaller diameter.

Oklahoma soil studies, J. H. BONE (*Oklahoma Sta. Bul. 42, pp. 26, figs. 8*).—In this bulletin an account is given of experiments during 3 years on the influence on soil moisture of plowing, subsoiling, cultivation, rolling, and manuring; data on the moisture content of upland and bottom lands, mechanical analyses, specific gravity, water-holding capacity, and rate of evaporation of different kinds of soil; and humidity and rainfall of 1898 are also reported and discussed. The moisture content was calculated from determinations made in samples taken in the usual way, the results being given in tables and diagrams.

"Soil plowed in March contained more moisture than that plowed about the middle of April. Shallow plowing did not maintain as much moisture in the soil as deep plowing. Subsoiled land contained more moisture than land not so treated. The yield of corn on a plat subsoiled in the spring was less than on a plat not subsoiled. Stubble should be plowed as soon after harvest as is convenient, and harrowed occasionally until sown to wheat. . . .

"The frequency of the cultivation of crops depends upon the season. Plats having two cultivations gave larger yields than others having nine cultivations. . . . Poor cultivation affects Indian corn more than it does Kafir corn.

"Increasing the supply of decayed vegetable matter is desirable for most Oklahoma soils. In one case there was an average difference of 2.5 per cent of soil moisture in the first foot of soil during the period of most active growth in favor of the soil manured and subsoiled.

"Rolling did not tend to conserve soil moisture or increase the crop yield. Rolled soil is blown by winds more readily and is not in condition to receive the rainfall to the best advantage.

"Bottom land did not dry out so completely as upland, nor did it hold as much moisture when full. . . .

"The soil moisture was much higher during 1898 than during 1897. Upland prairie contained a yearly average of 18.5 per cent in 1898 and 16.6 per cent during 1897.

Upland plowed soil to the depth of from 3 to 12 in. contained 18.2 per cent of moisture during 1898 and 16.6 per cent during 1897."

Science of soils, P. V. OTOTSKI, editor (*Pochvovyedyeniye. St. Petersburg: Soil Comm. Imp. Free Econ. Soc., 1899, No. 1; rev. in Selsk. Khoz. i Lyesov., 193 (1899), June, pp. 716–713*).—Of the articles in the first number of this new periodical two are of especial interest: (1) The science of soils and forestry, by G. F. Morozov, and (2) the soil zones of European Russia, in connection with the salt (alkali) content and the character of the forest vegetation, by G. N. Vysotski. In the latter article the author points out the relation of the salt content in the subsoils to the soil zones. As is well known, the soils of the plains of European Russia can be divided, according to the classification of Sibirtzev, into zones, from the north to the south, in the following order: (1) "Podzols" (more or less pure, fine silica; the German *Bleisand*), (2) gray forest soils, (3) chernozem, and (4) soils of the dry (desert) steppes. In the same direction a gradual increase of the amount of soluble salts is observed in the subsoils. In the first zone no such salts are found; the second zone is characterized by the presence of calcium carbonate; in the third zone there is observed besides lime, gypsum, and in the fourth zone are found besides these salts common salt and its usual associates. In correspondence with this each zone is characterized by its particular vegetation. The first zone is the region of mixed forests, the second of oak forests, the third of steppe bushes, and the fourth is distinguished by the vegetation peculiar to alkali lands.—P. FIREMAN.

On the waters of the salt lake of Urmi, R. T. GÜNTHER and J. J. MANLEY (*Proc. Roy. Soc.* [*London*], *65* (*1899*), *No. 419, pp. 312–318*).—The results of chemical and physical examinations of the water of this Persian lake are reported.

Bacteriological examinations of water samples, F. D. CHESTER (*Delaware Sta. Rpt. 1898, pp. 50–52*).—Notes are given on bacteriological examinations of 2 samples of water from which several bacteria were isolated. Two of the species were of especial interest since the presence of colon bacillus indicated an infection with fæcal matter, and the *Bacillus ærogenes* indicated a contamination with milk refuse or other household waste.

The study of the soil, A. DE VILLÈLE (*Rev. Agr. Reunion, 5* (*1899*), *No. 7, pp. 303–306*).

The soluble mineral matter of soils, T. H. MEANS (*U. S. Dept. Agr. Yearbook 1898, pp. 495–504*).—A general discussion of this subject under the following heads: The weathering of rocks and formation of soluble matter, absorption of salts by soils, conditions favoring the formation of alkali, kinds of alkali, effect of irrigation upon alkali, and methods of removing alkali.

The movement and retention of water in soils, L. J. BRIGGS (*U. S. Dept. Agr. Yearbook 1898, pp. 399–404*).—This subject is briefly discussed under the following heads: Surface tension of water, capillary movement of water, and the influence of texture of soils upon movement of water. A technical discussion of this subject has been given in a bulletin of the Division of Soils of this Department (E. S. R., 9, p. 732).

Soil temperatures at Riga, G. SCHWEDER, Jr. (*Die Bodentemperatur bei Riga. Riga, 1899, pp. 24*).

On the soil relations of the North German flat lands, G. F. BURGUY (*Inaug. Diss., Berlin, 1899, pp. 51*).

The soil relations of the Prussian flat lands, a geological-agronomic sketch, H. GRUNER (*Die Bodenverhältnisse des preussischen Flachlandes; eine geologisch-agronomische Skizze. Berlin: Paul Parey, 1898, pp. 20*).

Control and fixation of shifting sands, J. GIFFORD (*New York, 1898, pp. 14; reprinted from Engineer. Mag., Jan., 1898*).

The reclamation of drifting sand dunes, J. MCLAREN (*Forester, 5 (1899), No. 10, pp. 222, 223*).—Gives an account of experiments in Golden Gate Park, San Francisco. The sand was first bound with *Calamagrostis arenaria*, after which a large number of trees were planted, the most satisfactory ones being *Acacia latifolia*, *A. lophantha*, the Monterey pine, the Monterey cypress, and the tamarisk and several species of Eucalyptus.

The progress of marsh culture during late years, C. VON FEILITZEN (*K. Landt. Akad. Handl., 33 (1899), No. 3, pp. 154–167*).

The practical bearing of some of the field and pot experiments conducted at the Rhode Island Station, H. J. WHEELER (*Rhode Island Sta. Bul. 53, pp. 51–63*).—A summary of the results of direct practical value obtained in investigations on potato scab (E. S. R., 10, p. 967); the poisonous or unsatisfactory action of ammonium sulphate as a fertilizer (E. S. R., 9, p. 937); the effect of acid soils on the growth of plants (E. S. R., 10, p. 939); the distribution of acid soils in Rhode Island (E. S. R., 10, p. 938); the assimilability of the nitrogen in nitrate of soda, sulphate of ammonia, and dried blood on an acid soil before and after liming (E. S. R., 10, p. 937); and the fertilizer requirements of different kinds of soil (E. S. R., 10, p. 937).

Soil bacteria in their relation to agriculture, F. D. CHESTER (*Delaware Sta. Rpt. 1898, pp. 59–100, figs 2*).—This is the full technical review of investigations on this subject, a popular summary of which was given in Bulletin 40 of the station (E. S. R., 10, p. 334). This paper "contains all references, and the detailed results of studies of the bibliography of soil bacteriology, exclusive of the subject of nitrogen assimilation, which will be considered in a future report."

FERTILIZERS.

The preservation and relative value of the nitrogen of barnyard manure, C. RAGOYSKI (*Inaug. Diss., Leipsic, 1899; abs. in Chem. Ztg., 23 (1899), No. 64, Repert., p. 235; Ztschr. Landw. Versuchsw. Oesterr., 2 (1899), p. 391; Ann. Agron., 25 (1899), No. 5, pp. 244–248; Jour. Chem. Soc. [London], 75 (1899), No. 441, II, p. 512*).—The experiments here reported were made with 6 kg. lots of an artificial manure consisting of 61.7 per cent of cow dung, 26.7 per cent of liquid manure, and 11.6 per cent of straw. The lots of manure were kept for 56 days in glass cylinders either alone or treated with various preservatives—a mixture of sulphuric and hydrofluo-silicic acids (a by-product from the manufacture of aluminum), calcium carbonate, lime and soil, and soil alone.

The untreated manure lost 36.6 per cent of its nitrogen in 56 days. The addition of 1 per cent of the acid mixture reduced the loss to 4.7 per cent. This is a greater saving than can be accounted for by the fixing of the ammonia by the acids, and is attributed in part to the action of the hydrofluo-silicic acid in checking biological processes in the manure. Lime was very effective in preserving the nitrogen, but its action was irregular. In one case with lime used in connection with a covering of soil there was an actual gain of nitrogen; in another the loss was only 7 per cent. When lime was used in connection with soil mixed with the manure the loss was 17.6 per cent. Soil alone used as a covering to the manure reduced the loss to 18.8 per cent; mixed with the manure the loss was 22.3 per cent.

An examination of the nitrogenous matter of the manure by Stutzer's copper hydroxid method showed an increase of 25.6 per cent in the insoluble (albuminoid) nitrogen in manure treated with 1 per cent of the acid mixture, 33 to 38.5 per cent with lime and soil, and 41.2 per cent with soil alone mixed with the manure. Pot experiments with mustard, however, did not indicate that this nitrogen was unassimilable.

The author concludes that only the nitrogen of the liquid manure was available to the plants.

It was observed that the more highly nitrogenous the manure the less the amount of water required to produce a unit of dry matter in the crop.

P. P. Dehérain questions the accuracy of these results on account of the smallness of the samples of manure experimented with. He also points out that while only the nitrogen of the liquid manure was utilized in the time over which the experiment extended, that of the feces and straw would undoubtedly have become available in time.

Plat experiments with legumes, W. S. SWEETSER (*Pennsylvania Sta. Rpt. 1897–98, pp. 120–133*).—This article is a report on plat experiments with legumes conducted for the purpose of comparing the amount of total dry matter, ash, nitrogen, phosphoric acid, potash, and lime in the different crops. Crimson clover was grown on 3 different plats and timothy on 1 plat for comparison. Each crop is briefly described, and the results are tabulated. The amounts of dry matter and fertilizing substances produced per acre by the various crops, considering the entire plant, are given in the table below:

Yields of forage plants per acre (tops and roots).

	Total yield.	Dry matter	Ash.	Organic matter	Nitrogen.	Phosphoric acid.	Potash.	Lime.	Nitrate of soda furnishing same amount of nitrogen.
	Lbs	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*
Flat pea	41,412	9,073	906	8,167	239.8	49.8	161.8	122.2	1,495 7
Canada field pea	21,582	4,218	615	3,603	114.6	30.3	54 0	73.1	716.3
Spring vetch	10,740	6,327	609	5,718	127.3	58.2	138.0	143.7	795.7
Sand vetch	8,316	2,713	252	2,461	78.7	22.7	52.8	42.7	491.9
Medium red clover	29,760	7,438	626	6,812	143.7	39.6	156 6	98.3	898.2
White clover	31,440	6,349	723	5,626	173.8	51 0	179.4	95.6	1,086.3
Alsike clover	24,786	5,910	603	5,307	119.8	36.1	155.9	86.1	749 0
Crimson clover	18,456	4,477	584	3,893	99.4	25.5	85.9	79.3	621.3
Do	42,900	6,499	627	5,872	163.4	34.3	155.3	117.1	1,021.2
Do	16,290	2,836	294	2,542	62.1	14.0	52.5	58.4	388.1
Timothy	21,750	6,281	555	5,726	47.0	27.5	78.0	35.5	....

Note on phosphates, J. JOFFRE (*Bul. Soc. Chim. Paris, 21 (1899), No. 10, pp. 511–513*).—In previous experiments (E. S. R., 10, p. 218) in the laboratory the author showed the low solubility of apatite and other forms of tricalcium phosphate both in pure water and in water containing carbon dioxid. The present article reports the results of tests of the fertilizing value of different phosphates with white mustard grown in sand or mixtures of sand with peat and calcium carbonate. The comparative effectiveness of the different phosphates thus found is shown in the following table:

Comparative fertilizing effect of different phosphates on white mustard.

	Sand.	Artificial soil.
Without phosphate	100	100
Apatite	100	112
Tricalcium phosphate (bone ash)	150	142
Tricalcium phosphate, gelatinous	246	197
Monocalcium phosphate	321	359

Analyses of commercial fertilizers, J. L. HILLS, C. H. JONES, and B. O. WHITE (*Vermont Sta. Buls. 69, pp. 41–51; 70, pp. 55–68; 71, pp. 71–116*).—These bulletins report results of inspection of fertilizers in Vermont during the spring of 1899, comparing the results with those obtained in previous years.

"The station has analyzed 137 brands, the output of 18 companies, all drawn from dealers' stocks, all this year's goods.

"Three-fourths of the brands were up to or above guaranty, one-fourth fell short somewhat, while one-tenth failed to furnish a commercial equivalent of their guaranties. A few cases of deficiency were serious. The percentage of failure to meet claims is greater than has been found of late years.

"While as a rule the quality of the crude stock used was good, there were some cases which seem open to criticism. Two-fifths of the brands carried no water-soluble nitrogen. Laboratory methods seem to indicate that somewhat inferior forms of nitrogen were used in certain cases, notably in some low-grade goods and by some companies. The phosphoric acid was in some cases quite largely in the insoluble or reverted forms, indicating apparently either imperfect manufacture, old goods, or more or less use of (agriculturally) inferior forms of this ingredient. Sulphate of potash is claimed to be present in nine-tenths of the brands, but was actually found in less than one-eighth of the entire number.

"The average selling price approximated $28.75, and the average valuation $17.39. Two dollars in every five paid for fertilizers met costs of manufacture and sale. The same amount of plant food which cost a dollar might have been bought at retail for cash at the seaboard for 56 cts. in average low-priced goods, for 61 cts. in average medium-grade goods, and for 66 cts. in average high-priced goods. In one-third of the entire number of brands a dollar was charged for amounts of plant food which might have been bought in the manner above stated for 55 cts. or less. 'Cheap fertilizers' are usually the most expensive to buy.

"The average composition of the brands sold is slightly lower than last year. Selling prices have dropped and plant food is as cheap as it ever was. Notwithstanding these facts, buying mixed goods on time is still a far more costly method of getting plant food than is home mixing or buying on special order.

"The comparison of analyses of 133 brands for 5 years shows in some essential evenness and in others considerable variation in composition."

Manures in Egypt and soil exhaustion, G. P. FOADEN and W. C. MACKENZIE (*Jour. Khed. Agr. Soc. and School Agr., 1 (1899), No. 4, pp. 129–170*).—A general discussion of this subject, special attention being given to the fertilizing value of Nile mud, barnyard manure, sebakh coufri (remains of ancient villages), bones, nitrate-bearing clays, and sewage, and to the demand on the fertility of the soil of cotton, "berseem" (Egyptian clover), "berseem-bagazi" (alfalfa), sugar cane, wheat, barley, maize, beans, and potatoes.

Straw and peat for litter (*L'Ing. Agr. Gembloux, 10 (1899), No. 1, pp. 37–39*).—Their comparative merits are discussed.

Manurial value of ammonium sulphate, J. MUIR (*Jour. Gas Lighting, 74 (1899), pp. 163–168, 223–227, 287–292, 359–364; abs. in Jour. Soc. Chem. Ind., 18 (1899), No. 9, p. 846*).—A prize essay summarizing the information on this subject.

General fertilizer experiments, E H. HESS (*Pennsylvania Sta. Rpt. 1897–98, pp. 146–153*).—This is a summary of results obtained during 1897 in combined fertilizer and rotation experiments begun at the station in 1883 (E. S. R., 9, p. 823).

Commercial fertilizers, H. J. WHEELER, B. L. HARTWELL, and C. F. KENYON (*Rhode Island Sta. Bul. 54, pp. 67–85*).—This bulletin discusses fertilizer inspection in Rhode Island, makes suggestions regarding the purchase and sale of fertilizers, gives a schedule of trade values of fertilizing materials, explains the terms used in fertilizer analysis, and reports analyses and valuations of 13 samples of fertilizers.

Analyses of commercial fertilizers, M. B. HARDIN (*South Carolina Sta. Bul. 43, pp. 30*).—This includes statements regarding the composition and valuation of fertilizers, directions for taking samples, the law and regulations governing the sale of fertilizers in South Carolina, and analyses and valuations of 327 samples of fertilizers inspected during the season of 1898–99.

Fertilizers and fertilizer analyses, H. H. HARRINGTON (*Texas Sta. Bul. 51, pp. 24–38*).—The text of the law providing for the inspection of fertilizers and commercial poisons recently passed by the legislature of Texas, and discussions of the nature, function, valuation, and use of fertilizers, and analyses of 15 samples of fertilizing materials, including bat guano and bat-guano ash, mineral phosphates, acid phosphates, bone meal, tankage, cotton-hull ashes, sulphate of ammonia, kainit, and barnyard manure.

Commercial fertilizers, B. H. HITE and T. F. WATSON (*West Virginia Sta. Bul. 57, pp. 12*).—This bulletin gives a schedule of trade values of fertilizing materials and tabulated analyses and valuations of 149 samples of fertilizers.

Commercial fertilizers, H. A. HUSTON and W. J. JONES (*Purdue Univ. Spec. Bul., May, 1899, pp. 8*).—This bulletin discusses the extent of the fertilizer trade in Indiana and gives the text of the amended fertilizer law which went into effect April 28, 1899; notes on valuation, and tabulated analyses and valuations of 386 samples of fertilizers legally on sale in Indiana in May, 1899. The amended law provides for the taking of samples of fertilizers actually found in the market. Heretofore only analyses of samples supplied by the manufacturer have been published.

FIELD CROPS.

Cotton experiments, B. C. PITTUCK (*Texas Sta. Bul. 50, pp. 21*).—Variety, fertilizer, and distance experiments were continued in 1898 (E. S. R., 10, p. 342). No fertilizers were added in 1898, the residual effect of the applications made in 1897 being observed. The data for the different experiments are tabulated. Short descriptions are given of 31 varieties of cotton grown either in the variety or fertilizer tests and the same classified with regard to quality.

Twelve varieties were tested at the station and also at the Beeville Substation. Beck Big Boll has given the largest average yield of seed cotton for a period of 3 years at the station, 1,390 lbs. per acre. This variety also gave the largest money returns of the varieties tested in

1898, though the largest yield of seed cotton in 1898 was afforded by Dixon Improved, 1,390 lbs. per acre. At the Beeville Substation the largest yields of seed cotton of varieties tested in 1898 were made by Nancy Hanks, Gilbert Lamb Wool, and Hawkins Extra Prolific; and the largest money returns by Hawkins Extra Prolific, Griffin Drouth Proof, and Nancy Hanks, in the order named.

The residual effect of the fertilizers in 1898 was much greater than the original effect in 1897, the increase over the control plats varying from 0.77 to 65.9 per cent, while in 1897 the increase over the controls varied between 0.77 and 11.8 per cent. The largest yields of seed cotton were obtained on the plats which had been fertilized with cottonseed meal at the rate of 500 lbs. per acre. The plats fertilized with either boneblack or bone meal followed quite closely. Plats fertilized with wood ashes gave the best results among those which had received potash and lime fertilizers and plats fertilized with barnyard manure and acid phosphate the best among those receiving complete fertilizers. There was but little difference in the average yields of seed cotton of 5 varieties whether they were planted in rows 3 by 2, 4 by 2, or 4 by 3 ft. apart, but a considerable decrease in yield followed when the cotton was planted in rows 5 ft. apart and 3 ft. distant in the rows.

Varieties of cotton, J. S. NEWMAN, D. R. COKER, and H. HAMMOND (*South Carolina Sta. Bul. 42, pp. 8*).—Data for tests of 18 varieties of cotton at the station, 4 in the upper pine belt in Darlington County, and 8 on heavy clay soil on Beech Island, are reported.

Texas Oak, Bates Improved Prolific, and Drake Cluster, in the order named, gave the largest yield of lint per acre at the home station. Considerable variation in the earliness of the different varieties is shown. King Improved had yielded 92 per cent of its entire crop up to October 27, while Peterkin Improved had yielded up to the same period but 69 per cent. Bates Improved Prolific had the largest proportion of lint to seed cotton, 37.6 per cent. Ginned samples of the different varieties were classified by experts as "fully middling," "good middling," and "fully good middling," with the exception of Kennard and Jackson Limbless, which were graded as "barely good middling."

Jones Improved gave the best yield of the 4 varieties tested in the upper pine belt region, 468.58 lbs. of lint per acre; and African, King, and Truitt, in the order named, the largest yields of seed cotton of the 8 short staple varieties tested at Beech Island.

Experiments with nitrate of soda on forage crops, E. B. VOORHEES (*New Jersey Stas. Bul. 136, pp. 28–31*).—Experiments were made in fertilizing corn, oats, peas, barnyard millet, cowpeas, and soy beans with nitrate of soda, on a fair quality of clay loam in a good state of cultivation. Five groups of 2 plats each were used. They had previously received fertilizers at the rate of 200 lbs. of acid phosphate and 100 lbs. of muriate of potash per acre. One plat of each group was left unfertilized; the other was fertilized at the rate of 75 lbs. of nitrate of soda at the time of seeding and 75 lbs. later. The dates of seeding the different crops, total yields per acre, cost of increased yield, etc., are shown in tabular form. The results show a much larger increase from fertilizer with cereals than with legumes, the increase varying from 10.9 per cent with cowpeas to 52.5 with oats and peas. The nitrate had a tendency not only to increase the yield of the different crops, but to hasten the period of development. The cost of the increase with nitrate of soda amounted to only one-fourth its average value in the case of corn, millet, and oats. For the cowpeas and soy beans, however, the cost was considerably higher and left a profit only in the case of the cowpeas.

Experiments with different forms of nitrogen on white potatoes, G. A. MITCHELL (*New Jersey Stas. Bul. 136, pp. 26–28*).—An experiment was made to determine the relative value for potatoes of different forms and varying amounts of nitrogen fertilizers on light sandy soil poor in physical condition. Twenty plats, each $\frac{1}{20}$ acre in extent, were used, and from 150 to 350 lbs. of nitrate of soda, 120 to 280 lbs. of sulphate of ammonia, and 340 to 800 lbs. of cotton-seed meal per acre, applied separately to the different plats. The quantity of fertilizer used per acre on each plat and yields from the different plats are tabulated. Owing to the poor physical condition of the soil the yields in all cases were low, not exceeding in any instance 95 bu. per acre. The nitrate of soda was the most effective form of fertilizer used, the increased yield from this material being 84 per cent, while that from ammonia was 77 and from cotton-seed meal 38 per cent greater than the control plat.

Experiments with wheat, corn, and potatoes, H. J. PATTERSON ET AL. (*Maryland Sta. Bul. 62, pp. 187–205*).—The experiments consisted of variety tests with wheat; culture experiments with corn; and variety, culture, and spraying experiments with potatoes.

Wheat.—The best yields in a test of 30 varieties in 1898 were made by Lebanon 35.4 bu., Currell Prolific 35.3 bu., and Dietz 34.5 bu. per acre. Data for the yields of 80 varieties tested since 1889 are given. Fultz has given the largest average yield of any of the varieties tested for 7 years, 36.1 bu. per acre.

Corn.—Data of tests to determine the relative value of deep and shallow cultivation, different numbers of cultivations, wide and narrow rows, and planting in drills and checks are tabulated for each year from 1883 to 1898, as is also the rainfall for the growing season. The average yields for this period are slightly in favor of deep cultivation. Corn drilled in rows 3¾ ft. apart and 22½ in. distant in the row has given increased yields each year of the test over corn planted in hills 3¾ ft. distant each way and 2 stalks in a hill. Only inconclusive results have been obtained in the other tests.

Potatoes.—Holton Rose and Carman No. 3 gave the best yields of 52 varieties tested in 1897, 263.6 and 252.9 bu. per acre, respectively; while the 3 leading varieties in 1898 were Vigerosa, 134 bu., Early Vaughn, 132 bu., and Bovee, 131 bu. per acre.

Potatoes sprayed with Bordeaux mixture have given increased yields over unsprayed potatoes each year from 1893 to 1898, and but little difference has been observable whether early or late spraying was practiced. Deep cultivation and narrow rows have given slightly better yields than shallow cultivation and wide rows. No decisive results either way have been obtained in the test of early *vs.* late and ridge *vs.* flat cultivation.

Experiments in the seeding of sainfoin and lucern (*Jour. Bd. Agr.* [*London*], *6* (*1899*), *No. 1*, *pp. 39–44*).—The results, and in some cases the tabulated details, are given of experiments carried out in several places in England to determine (1) "the relative values of sainfoin and lucern, (2) the effect of sowing these seeds broadcast and with a drill, and (3) the relative results obtained by sowing them alone or mixed with grass and clover seed." The nature of the different soils is noted in each instance. In general heavier crops were secured with both sainfoin and alfalfa when they were mixed with grasses and clovers than when they were sown alone. Not much difference was noticeable in the yields from plats sown broadcast and those that were drilled. The data as to the relative yields of the two plants on different plats are conflicting.

The sugar beet in Maryland, H. W. WILEY (*Maryland Sta. Bul. 61*, *pp. 169–186*).—A detailed historical account is given of the sugar beet in Maryland, with notes on the possibility of its successful culture in some portions of the State. Tabulated analytical data show the sugar content and percentage of purity of the crop grown in the State in cooperative tests during the season of 1898. The average weight of 31 samples of sugar beets grown in 1898 was 22 oz., average sugar content 10.4 per cent, and average coefficient of purity 76 per cent.

In the present state of the industry the author believes that "Maryland can not successfully compete in the manufacture of beet sugar with the more favorable localities of the United States."

Utah sugar beets in 1898, L. FOSTER and J. STEWART (*Utah Sta. Bul. 59*, *pp. 93–129*).—This bulletin summarizes the results of 5 years' experiments with sugar beets in Utah, suggests future lines of work that may be profitably undertaken with this crop, discusses the development of the sugar-beet industry, process of manufacture, and beet-sugar factory conditions in Utah; and gives the analyses and other data for 316 samples of sugar beets grown in cooperative experiments throughout the State in 1898.

The beets grown in 1898 had an average sugar content of 15.82 per cent and a purity of 86.89 per cent. The average sugar content for all the beets grown in the State during the 5 years' experimentation is 14.66 per cent, and the average purity 84.85. Several of the samples analyzed in 1898 had been grown on slightly alkali soils. The sugar content and purity of all of these samples were high.

The authors consider that experiments in this line have now progressed sufficiently to demonstrate the suitability of Utah for sugar-beet culture, and in future the station will confine its investigations to special problems in their culture or in the use of sugar-beet factory by-products.

The progress of "moor culture" in Prussia, H. HEINE (*Fühling's Landw. Ztg.*, *48* (*1899*), *Nos. 14, pp. 550–554; 15, pp. 567–571*).—A history of the improvement of moor lands in Prussia, with a description of the methods employed.

The influence of methods of sowing on the growth of the grain (*Landw. Wchnbl. Schleswig-Holstein, 49* (*1899*), *No. 32, pp. 593–595*).—A popular discussion on how the growth of cereals is affected by the time and methods of seeding.

How commercial fertilizers should be used on clay, loam, sand, and marsh soils, K. DE VRIEZE (*Hoe kunstmest gebruikt moet worden op klei-,leem-,zand- en veengronden. Groningen: J. B. Wolters, 1899, 4. enl. ed., pp. VIII+116*).

The improvement of cultivated plants, J. H. MANSHOLT (*Orgaan Ver. Oudleer. Rijks. Landbouwschool, 11* (*1899*), *No. 134, pp. 143–147*).—A discussion of the different methods employed.

Field experiments in 1897–98 (*Bul. Agr.* [*Brussels*], *15* (*1899*), *No. 4, pp. 179–204*).—Results of cooperative experiments in testing varieties of oats, potatoes, and rye in the various provinces of Belgium are given in tabular form.

Belgian agricultural cooperative societies (*Jour. Bd. Agr.* [*London*], *6* (*1899*), *No. 1, pp. 22–27*).

The Holtdorf culture experiments in 1897–98, WOLCKENHAAR (*Landw. Wchnbl. Schleswig-Holstein, 49* (*1899*), *No. 36 pp. 675–678*).—Partial data are given for variety tests with rye, winter oats, wheat, oats, and potatoes. The best yields of the late varieties of potatoes were made by Silesia, 30,050 kg. per hectare; and Professor Maercker, 28,450 kg. per hectare, followed by Queen of the South, Professor Sidam, Professor Kühn, and Schwan, all with yields exceeding 20,000 kg. per hectare.

Experimental work in field and garden, A. LOW (*Trans. Massachusetts Hort. Soc. 1899, pt. 1, pp. 21–31*).—This is a paper read before the Massachusetts Horticultural Society, in which the author gives his results obtained in variety and culture experiments with garden peas, sweet corn, potatoes, and several miscellaneous crops for green manuring. Alaska was the earliest garden pea, Quincy Market the earliest variety of sweet corn, and Early Fortune one of the earliest and most satisfactory potatoes tested. In a comparison of the relative values of seed potatoes from different localities the best yields were usually from seed obtained from the more northern districts. Of 10 varieties of potatoes tested, Carman No. 1, Carman No. 3, Enormous, and Uncle Sam proved the most hardy against blight.

Arrowroot, A. J. BOYD (*Queensland Agr. Jour., 4* (*1899*), *No. 5, pp. 335–339, fig. 1*).—This gives directions for growing the crop and handling the bulbs, together with a description of the machinery used in working up the crop.

Culture of winter barley on sandy soils, W. BESELER (*Deut. Landw. Presse, 26* (*1899*), *No. 58, p. 668*).—A brief report on a culture experiment with winter barley on sandy soil.

The cultivation of broom corn, D. JONES (*Queensland Agr. Jour., 4* (*1899*), *No. 6, pp. 424–426; 5* (*1899*), *No. 1, pp. 1–7, figs. 5*).—A discussion of the characteristics of the more desirable varieties of broom corn now being grown in Queensland, with directions for its culture and a description of the machinery employed.

Sweet and bitter cassava, S. BOYCE (*Florida Agr., 26* (*1899*), *No. 40, p. 690*).—Notes on the different physical characteristics of sweet and bitter cassava, with detailed directions for extracting the poisonous principles of bitter cassava before it is used as food.

Cassava and velvet beans, G. E. PYBUS (*Florida Agr., 26* (*1899*), *No. 39, pp. 596, 597*).—Cultural suggestions based on the results of the author's experience in growing these plants.

Corn culture, P. THIELE (*Der Maisbau. Stuttgart: Eugen Ulmer, 1899, pp. 152, figs. 61*).—This work is intended as a guide to the culture, care, and improvement of corn and is based on studies made by the author in the corn-growing districts of Hungary. Besides dealing with the ordinary cultural operations, the uses of corn and its improvement by selection are discussed and descriptions given of 30 different varieties of corn with illustrations of the ear and kernels in each case. The machinery used in cultivating, shelling, and grinding corn are also described and illustrated, as well as cribs for storage, etc.

Report on experiments in the cultivation and preparation of flax in Demyan district, in the Government of Novgorod, in the years 1896–1898, A. P. MARG (*Selsk. Khoz. i Lyesov., 192 (1899), Feb., pp. 363–388*).

Suggestions on the improvement of flax culture, KUHNERT (*Mitt. Deut. Landw. Gesell., 14 (1899), No. 14, pp. 221–226*).

The culture of sisal hemp (Agave sisalana), A. TERRACCIANO (*Bol. R. Orto Bot. Palermo, 2 (1898), No. 3–4, pp. 91–111*).

Russia's flax and hemp crops of 1898 (*U. S. Consular Rpts., 1899, No. 229, p. 230*).—Statistics on area and yield for the years 1896-1898.

Millets, T. A. WILLIAMS (*U. S. Dept. Agr. Yearbook 1898, pp. 267–290, figs. 6, pls. 2*).—This is a popular article giving descriptions of cultivated varieties of millets, their uses, feeding value, and fertilizing value. Cultural methods are suggested and injuries resulting from feeding millet discussed.

The author separates the different varieties into 3 groups, namely, foxtail, barnyard, and broom corn millets. Under foxtail millets, Common millet (*Chætochloa italica*), German millet (*C. italica*), Golden Wonder millet (*C. italica*), and Hungarian millet (*C. italica* var. *germanica*) are given as standard varieties of the group. Under barnyard millets, Shama millet or jungle rice (*Panicum colonum*), Sanwa millet (*P. frumentaceum*), and barnyard millet (*P. crus-galli*) are described. Under broom-corn millets Manitoba, Californian Beauty, French, Turkish, Broom corn, White French, Chinese White, Japanese White, Red French, and Japanese Red are mentioned.

Study on sugar cane, H. PELLET (*Sucr. Indig., 53 (1899), Nos. 15, pp. 444–447; 16, pp. 479–481*).

Yields of beets as affected by light (*Beet Sugar Gaz., 1 (1899), No. 8, pp. 18, 19*).—This article summarizes the results which have been obtained in growing sugar beets in partial darkness and in light. Light increases the percentage of sugar in the beet and decreases the nonsugar and water constituents.

Germany's beet-sugar industry from 1877 to 1899, H. W. DIEDERICH (*U. S. Consular Rpts., 1899, No. 226, pp. 471–474*).—A tabular compilation of statistics bearing on the beet-sugar industry of Germany during the past 20 years.

The sugar industry in Roumania, A. E. MISLIN (*Oesterr. Chem. Ztg., 2 (1899), No. 17, pp. 458–464*).—This is a communication from the experiment station at Bucharest on the growing of sugar beets, including the time of seeding, distance of planting, size of seed, use of fertilizers, varieties, and meteorological data; and the technology of beet-sugar manufacture.

Some figures from two Westmoreland sugar estates, P. H. GREG (*Jour. Jamaica Agr. Soc., 3 (1899), No. 9, pp. 521–533*).—Data on the yields per acre, juice in canes, value of product, etc.

Tobacco culture, J. M. PRIEGO (*El cultivo del tabaco. Madrid: M. G. Hérnández' Sons, 1899, pp. 133*).—The work treats of the tobacco plant in general and discusses soils, climate, cultivation, varieties, and their degeneration, cost of production, and the different products obtained.

Improving the quality of tobacco by means of fertilizer applications, A. STUTZER (*Tropenpflanzer, 3 (1899), No. 6, pp. 260–263*).

Tobacco, T. H. SHARP (*Jour. Jamaica Agr. Soc., 3 (1899), No. 9, pp. 550–554*).—Popular articles on the culture of tobacco, written for the purpose of assisting the tobacco industry in Jamaica.

Culture of tobacco in Tunis, F. MALET (*Rev. Cult. Coloniales, 4 (1899), Nos. 30, pp. 343–347; 31, pp. 360–370; 5 (1899), Nos. 32, pp. 13–20; 33, pp. 56–61; 34, pp. 113–117*).—Extract from the *Bulletin de la Direction de l'Agriculture* of Tunis, dealing largely with the meteorology and tobacco soils in the neighborhood of Cape Bon, with notes on the cultural practices observed in these regions and on the export of tobacco.

The world's wheat supply, J. B. LAWES and J. H. GILBERT (*London: Spottiswoode & Co., 1898, pp. 16*).—Criticism of the statements of Sir W. Crooks relative to this subject. The article is a reprint of the authors' letter to *The London Times* of December 2, 1898.

Trials of rust-resisting wheats, A. C. MACDONALD (*Agr. Jour. Cape Good Hope, 15 (1899), No. 4, pp. 229–235*).—In continuation of previous investigations the rust-resistant qualities of Medeah, Italian, and Rietti wheat were tested. The experiment with Rietti was a failure owing to late sowing. In 13 cases Medeah was free from rust, slightly attacked in 4, and more or less affected in 9 others. Italian is reported free from rust in 17 cases, more or less affected in 23, and destroyed in 2 instances. This wheat is said to withstand drought well, but the grain is said to be too hard.

Course in practical agriculture; the food plants of warm countries and of the colonies, HEUZÉ (*Cours d'agriculture pratique; les plantes alimentaires des pays chauds et des colonies. Paris: Librairie de la Maison rustique, 1899, 2. ed., pp. 381, figs. 58*).—This treats of rice, sorghum, dolich bread, fruit, etc.

HORTICULTURE.

Field experiments with nitrogenous fertilizers, E. B. VOORHEES ET AL. (*New Jersey Stas. Bul. 136, pp. 31*).—Fertilizer experiments were made to determine "under field conditions the relative usefulness of the 3 distinct forms of nitrogen, viz, nitrate, ammonia, and organic, for crops belonging to that class in which rapid and continuous growth are important factors in determining the profits to be obtained in the growth of the crop." Detailed data for tests with beets, tomatoes, muskmelons, potatoes, sweet potatoes, and forage crops are given. The experiments with potatoes and forage crops are noted elsewhere in this issue (pp. 439, 440). The experiments were carried out both at the station and on farms in different parts of the State. In all cases the plats under experiment were well fertilized with the manurial elements, phosphoric acid and potash, previous to the application of the nitrogen.

Beets.—The soil upon which the test with table beets was made was a well-drained, sandy loam which had been cropped with table beets for nearly 10 years and had received a yearly dressing of 20 tons of barnyard manure and 1 ton of complete commercial fertilizer per acre. This same amount of fertilizer was again applied the season of the test. The object of the experiment was "to learn whether it would be profitable to add nitrogen in its most active form to the crop grown upon a soil thus abundantly supplied with plant food." Five plats each $\frac{1}{10}$ acre in size were used. One plat was used as a control. The others received 40, 50, 60, and 70 lbs., respectively, of nitrate of soda. The plants were set the last week in March and the fertilizer applied in three equal dressings April 22 and May 10 and 21. Harvesting began May 27 and continued until June 25. The number of bunches gathered from the various plats on the different dates of picking, selling price per bunch, and the value of the crop are given in tabular form, and the data are discussed.

The earliness of the crop was greatly hastened by the use of the nitrate. At the first picking the average yield of bunches from the nitrate plats was 63 per cent greater than on the check plats. At the gathering 4 days later this yield was 135 per cent greater and at the third gathering, June 3, 17½ per cent greater than on the check plat. From that time on the yields of the different plats were about equal. The different amounts of the nitrate increased the extra earliness of the beets from 10.1 per cent in the case of the plat receiving the least nitrate to 23.7 per cent in the case of the plat having the greatest amount, though not in a regular ratio. The largest prices were received for the earliest gathering, and the greatest net gain per acre, $27.10, was obtained from the plat fertilized at the rate of 700 lbs. of nitrate of soda per acre.

Tomatoes.—The test was made on sandy loam soil in a good state of cultivation and of fair quality. Four tenth-acre plats were used. One plat was used as a check, one received nitrate of soda at the rate of 150 lbs. per acre, one dried blood at the rate of 200 lbs. per acre, and one sulphate of ammonia at the rate of 120 lbs. per acre. Half the fertilizers were applied at the time of planting and the remainder 3 weeks later. Data as to date of picking, yield, selling price at the different dates of picking, etc., are tabulated. The largest yield of early tomatoes, the greatest number of prime fruits, the largest total yield, 21,695 lbs., and the largest money returns, $215.52 per acre, were furnished by the plat fertilized with nitrate of soda. The plat fertilized with sulphate of ammonia stood second, with a yield of 19,384 lbs. and a money value of the crop of $186.79; and the plat fertilized with dried blood last, with a yield of 12,898 lbs. and a money value of the crop of $121.67. The check plat gave a total yield of only 5,894 lbs. This had a money value of $51.02. The largest percentage of imperfect fruit on the fertilized plats was found where dried blood was used. The author believes the results show that nitrate of soda, applied in reasonable amounts, not to exceed 150 lbs. per acre, has a favorable influence on both the early maturity and the total yield of the crop rather than an unfavorable one as is sometimes believed.

Muskmelons.—The object of the work with muskmelons was (1) to compare the relative effects upon the yield and quality of crop of nitrate, ammonia, and organic forms of nitrogen, and (2) the effect of increasing amounts of these materials. Ten plats of light sandy loam soil, each $\frac{1}{10}$ acre in size, were used. Plat 1 was used as a check; the remaining plats were divided into 3 groups of 3 plats each. Plats 1 of each group received 15, 25, and 35 lbs., respectively, of nitrate of soda; plats 2, 12, 20, and 28 lbs., respectively, of sulphate of ammonia; and plats 3, 20, 33, and 47 lbs., respectively, of dried blood. "The actual nitrogen applied in the different forms was the same for each group." Half the fertilizers were applied at planting time and the remainder about 3 weeks later.

The largest average yield, 115 per cent increase over the check plat, and the greatest number of marketable fruits, were obtained from the plats receiving nitrate of soda, the smallest application giving the largest total yield and greatest money returns. The average yields obtained from the plats receiving dried blood were 91 per cent greater than the yield from the check plat and about 4 per cent greater than the average yield from plats fertilized with sulphate of ammonia. The effects of the fertilizers on earliness were conflicting in the different groups, nitrate of soda standing at the head in the first and third groups, and dried blood in the second.

Sweet corn.—The plan of this experiment was similar in character and purpose to that with melons, the number of plats, their arrangement, and the amount of fertilizers used on each plat and the method of application being the same. The weight and number of ears of corn grown on each plat, weight of stalk, cost of fertilizers, and total value of crop are given in tabular form. "The average increased yield [of ears] from the use of nitrate of soda was 21.1 per cent; from sulphate of ammonia, 25.4; and from dried blood, 34.9 per cent." And this yield was greatest, with but one exception, in group 3, which received the heaviest applications of fertilizers. The yield of stalks was increased by the use of nitrogen in every instance except on the plat which received the smallest application of nitrate of soda. The best average yields were made on the plats receiving sulphate of ammonia, and the yield of plats in group 2, which received medium amounts of fertilizer, was larger than in groups 1 or 3. The earliness of the crop was somewhat retarded by unfavorable weather. Notwithstanding this, the application of the fertilizers was profitable in all cases except with the smaller amounts of nitrate of soda and sulphate of ammonia in group 1. The author believes that aside from the determination of the most available forms of nitrogen, the experiment demonstrates the value of an abundance of all forms of fertilizer for this crop.

Sweet potatoes.—The relative effects of nitrate of soda and cotton-seed meal on the growth of sweet potatoes on a light sandy soil which lacked "'condition' and was poor in respect to physical character" was investigated. Two plats, each one-half acre in extent, which had been well fertilized with phosphoric acid and potash, were used. One plat was fertilized with nitrate of soda at the rate of 200 lbs. per acre and the other with cotton-seed meal at the rate of 456 lbs. per acre. The results are tabulated. The yield of "firsts" was 18.7 per cent greater and of "seconds" 22.8 per cent greater on the plat fertilized with nitrate of soda than on the plat receiving the cotton-seed meal.

Chemical studies of Oregon fruits—points on prune dipping, G. W. SHAW (*Oregon Sta. Bul. 56, pp. 8*).—It is said to be an almost universal custom in the State to dip prunes into a boiling solution of lye just previous to drying, to hasten the operation of drying, and to cleanse them and render the skin less tough. Results are given of experiments in dipping prunes in lye of different strengths, and of analyses with reference to alkalinity of 27 samples of concentrated lyes found in Oregon markets.

> "Prunes of normal size were subjected to treatment in a 1.25 per cent solution of lye for 20 seconds, and on removal from the solution were found to be well checked; but small prunes were very imperfectly checked, many of them not being affected at all. Increasing the time seemed only to cause the prune to crack deeply or the skin to roll up, leaving the flesh badly exposed. A trial with a solution of double the strength used at first, 2.5 per cent alkalinity, only caused the skin to roll up worse and the cracks to be made deeper and failed to produce a well-checked fruit."

The practical bearing of these experiments, in the opinion of the author, is "to enforce the idea of preliminary grading of fruit or, still better, the necessity of keeping trees in such a healthy condition as will permit them to bear only fruit of normal size."

No general rule can be given with regard to the use of lyes because of the great variation in strength of the different brands. Potash lyes, as a rule, are preferred to soda lyes because of their more ready solubility in the case of sprays and their easier removal from dipped fruit. Tables show the net weight, price per can, percentage alkalinity as soda, actual alkali per can, and the actual alkali purchased for 10 cts. for a number of different brands of lye. Great variation in the weight of cans, percentage alkalinity, etc., was found between different brands.

Pollination of pomaceous fruits, M. B. WAITE (*U. S. Dept. Agr. Yearbook 1898, pp. 167–180, figs. 13*).—This article consists largely of a review of the principal results of the author's work on pollination of the pear (E. S. R., 6, p. 47).

Experiments in cross pollination of the apple and quince are reported. The apple blossom and its adaptation for cross pollination are described. It was noticed in western New York that ordinarily there were not enough insects to insure complete pollination when the main body of the orchards come into bloom. To obviate this difficulty it is recommended that hives of bees be kept in the vicinity.

"The methods followed in the work on the apple were the same as in the experiments with pears . . . [and], in a general way, the results were similar. . . . The division of the varieties into self-fertile and self-sterile sorts was not nearly so well marked. Crossing gave decidedly better results in all cases than self-pollination."

Experiments with Norton Melon, a variety producing fruit of the choicest quality, indicated that high quality is not necessarily associated with self-sterility. Cross fertilized apples were larger, more highly colored, and better supplied with seed than those self-fertilized. Experiments with the quince showed no such striking benefits from insect visits as in the case of the pear and apple.

Soils and fertilizers for pineapples (*Queensland Agr. Jour., 4 (1899), No. 6, pp. 472, 473*).—It is stated that a sandy loam soil, rich in humus and having a hardpan clay subsoil, is absolutely unsuitable for pineapple culture in Australia, which is contrary to the experience of the Florida Station (E. S. R., 7, p. 214). It is stated also that in Australia, where the climate is subject to heavy rainfalls at certain periods of the year and at other times to comparatively long periods without rain or with only a small rainfall, the effect of the heavy rains on such a soil would be to saturate it completely, and as the water would have no means of escape it would stagnate and kill the plants. Perfect drainage is found to be essential to successful pineapple culture. It is further stated that the soil recommended for Florida conditions would dry out very rapidly, since after the moisture in the foot or so of soil has become exhausted the hardpan would absolutely prevent its being replaced by capillary action. The same soil would, however, be adapted to pineapples if it were not underlaid by hardpan.

Fertilizer experiments now in progress in Queensland indicate that pineapples are much benefited by applications of a mixture of soluble nitrogenous and phosphatic manures, but, contrary to the results obtained by the Florida Station, up to the present time potash has had little if any effect.

A method for the rapid propagation of the strawberry by layers and cuttings, C. GAZEAU (*Jour. Soc. Nat. Hort. France, 3. ser., 21 (1899), May, pp. 113-119*).—A method of propagating strawberries is described which, it is claimed, is especially suited to the rapid propagation of a variety from a few plants. In the spring, as soon as the first runner shows its terminal bud with its rosette of leaves, it is layered, leaving only the terminal leaves exposed. The runner proper is thus protected from accidents and the weather. It also does not lose by evaporation any of the sap that it receives from the mother plant. The bud itself is in intimate contact with a fine, moist, and well compacted soil, conditions much more favorable to rapid making of roots than are found in ordinary field culture. In about 12 days the bud has rooted and thrown out a runner which is a prolongation of the primary runner, and after a few days this also is layered as before. This operation is repeated for each new bud that appears. These may be six or eight or even more. The mother plant generally throws out eight or nine runners, each of which is treated in the same way. As soon as the buds of the primary runners have struck roots, they in turn form adventitious buds and throw out secondary runners which are also layered. The first few weeks the number of plants increases in arithmetical progression, but later, obviously, in geometrical progression.

When there is no longer room to make more layers, cutting must be resorted to. When the terminal rosette shows two well-formed leaves the runner is sectioned close to its mother plant and the cuttings are planted out. In the author's experience cutting was not so successful as layering; the plants are not so vigorous and do not multiply so rapidly, cutting yielding only about 35 per cent as many plants as layering in the same time. The mother plants are set 2 meters apart each way, preferably the preceding fall, in a deeply worked and heavily manured propagating bed. The growing season may be lengthened by starting the plants in a cold frame. Intense culture must be given and frequent waterings with a nitrogenous manure water. By massing plants that are to be used for propagation, the area to be cultivated and, consequently, the cost of cultivating is reduced to a minimum. Plants propagated by this method are exceedingly vigorous and yield an abundant harvest of very large fruit the following season, whereas by the ordinary method of propagation they do not yield until the second year.

Detailed cultural directions especially suited to this method are given throughout the article.

Hybrid coffee (*Gard. Chron., 3. ser., 25 (1899), No. 642, p. 240*).—The report of the Government gardens and parks in Mysore for 1897–98 states that the existence of hybrid coffee plants on several estates in southern India appears now to be an established fact.

> "These new forms are reported to combine, more or less, the characteristics of *Coffea liberica* and *C. arabica*, and are only found in localities where the 2 species have been cultivated and propagated together. They have not been introduced by the planters as new varieties, but were unknown prior to the introduction of the West African species *C. liberica*. It is therefore reasonably inferred that these intermediate plants are true hybrids. The most remarkable thing about them is their immunity from coffee-leaf disease, a condition which can only be attributed to enhanced vitality in the constitution of the hybrid. This is a discovery of much importance to the planter and will encourage him to pursue the operation of crossing on methodical lines with a view to raising improved strains of seed."

A small coffee plat consisting of 135 bushes, comprising 2 species and 1 variety, has been planted. Systematic hybridizing operations will be commenced as soon as these plants flower, which it is expected will be next season.

Irrigation of the vine during a late drought, A. MÜNTZ (*Compt. Rend. Acad. Sci. Paris, 128 (1899), No. 25, pp. 1189–1193*).—During a period of drought late in the season a test was made of the practicability of pumping water a considerable distance upgrade for irrigating a vineyard. The water was pumped 1,500 meters and raised 40 meters. The application was equivalent to 220 mm. of rain. The increase in yield was on the average from 25 to 30 per cent.

Analysis of the must showed that as a result of watering the water content of the fruit was increased and the sugar content decreased, but the relative decrease of sugar was much less than the relative increase in the size of the fruit—that is, there was a total increased production of sugar. The acid content was also considerably increased.

The cost of the irrigation in this case was about 60 francs per hectare, while the returns were from 200 to 250 francs per hectare more than from a check plat not watered.

The replanting of vineyards with American vines, J. M. GUILLON (*La reconstitution du vignoble. Cognac: Vve. G. Berauld, 1899, pp. 17*).—A general discussion of the subject. The three requirements for American vines used in replanting vineyards are that they be resistant to chlorosis and the phylloxera, and that the variety be adapted to the soil in which it is planted. Each of these requirements is discussed in detail from a practical standpoint. To insure resistance to chlorosis on soils having a lime content of not more than 15 per cent, use Riparia; 20 per cent, Riparia-Rupestris; 25 per cent, Rupestris; 35 per cent, Riparia-Berlandieri, Rupestris-Berlandieri, or Vinifera-Rupestris; above 35 per cent, Berlandieri or Vinifera-Berlandieri.

Rose culture in Oregon, G. COOTE (*Oregon Sta. Bul. 58, pp. 11, pls. 7*).—Popular directions are given for making and propagating midsummer and fall cuttings and Manetti stocks; for propagating by budding; and for planting, pruning, and disbudding roses. Brief notes are also given on the more usual insects and diseases affecting roses, with suggestions for their control.

High standard roses have not been successfully grown at the station, owing to the sudden variations in temperature which are liable to occur during the winter months. Some of these varieties, however, when grown on native wild stocks and covered in winter by a coating of snow have done well. Of the varieties thus grown La France, John Hopper, La Rhine, Gloire de Dijon, Gloire de Lyonnaise, and Queen of Morocco are noted as the best. Gloire de Dijon when grown on native brier was found to lose its climbing habits and made but little wood growth. Maréchal Niel was short lived, lasting only three or four years. Common Sweet Brier, worked close to the ground, is recommended as stock for this variety.

Can perfumery farming succeed in the United States? E. S. STEELE (*U. S. Dept. Agr. Yearbook 1898, pp. 377-398, figs. 7*).—The statistics of the trade in alcoholic perfumery are given and the methods of extracting essential oils briefly described. Experiments indicate that the rose, rose geranium, citrus fruits, and lavender can be successfully grown for perfumery in this country, so far as climate and soil are concerned. Notes are given on thyme, rosemary, orris or iris root, bitter almond, umbelliferous aromatics, violet, cassie or opopanax, tuberose, jasmine, and the following native perfumery plants: Sassafras, wintergreen, sweet birch, red cedar, wild ginger, sweet golden-rod, large-flowered magnolia, sweet bay (*Magnolia virginiana*), and yellow jasmine (*Gelsemium sempervirens*). From an economic point of view it is believed that the difficulty in the way of producing perfumery materials in this country is lack of information and experience and the cost of labor. Nevertheless it is believed that new industries in this class are feasible in particular localities.

Green asparagus out of season, J. FOUSSAT (*Rev. Hort. et Vit., 31 (1899), No. 9, pp. 199-202*).—Directions for forcing asparagus.

The cabbage crop (*Florida Agr., 26 (1899), No. 40, p. 610*).—The nitrogen content of different varieties of cabbage is noted and directions given for fertilizing cabbage, making the seed bed, sowing the seed, cultivation, and protection from insects, with suggestions as to best varieties to plant.

Dwarf tomatoes, W. J. GREEN (*Amer. Gard., 20 (1899), No. 250, p. 687*).—Cultural notes. The author advocates staking this crop.

Some tomato trials (*Amer. Gard., 20 (1899), No. 250, pp. 684, 685, fig. 1*).—Results with varieties of tomatoes in the *American Gardening* trial grounds are noted. The stake method of training with the continual removal of all lateral or side branches has given the most satisfactory results. The following varieties in the order named succeeded best in 1899: Stone, Royal Red, Crimson Cushion, Matchless, Trucker Favorite, Perfection, Thorburn Novelty, and a yellow sort, Golden Jubilee.

The softening of peas on boiling, A. J. SWAVING (*Landbouw. Tijdschr., 6 (1899), pp. 353–357*).—The author reports experiments on the effect of different soils and fertilizers on the composition of peas, with especial reference to their becoming soft on boiling.

Mushrooms, J. HOBSON (*Amer. Gard., 20 (1899), No. 245, p. 610*).—The preparation of the mushroom bed is discussed and precautionary measures to be observed in watering and otherwise caring for the crop noted.

Vegetable physiology applied to fruit-tree culture, G. BELLAIR (*Rev. Hort., 71 (1899), No. 16, pp. 376, 377*).—The value of proper lighting, the distance to set different vines and orchard fruits apart, and methods of their pruning to secure access of light are popularly discussed.

New nursery methods, N. E. HANSEN (*Nat. Nurseryman, 7 (1899), No. 8, pp. 89, 90*).—Paper read before the Philadelphia meeting of the American Pomological Society. In order to avoid a repetition of the widespread destruction of nursery stock and young orchards following the severe freezes of last winter, the author advises the adoption of the Russian method of using pure *Pyrus baccata* as stock.

A year among the orchards of Nova Scotia, C. H. HOOPER (*Author's ed.; repr. from Jour. Roy. Hort. Soc. England, 23 (1899), pt. 1, pp. 20, figs. 4*).—Paper on the present status of the fruit industry in Nova Scotia read before the Royal Horticultural Society of England at its meeting January 31, 1899. The grafting and pruning of apple trees; fertilizing, management, and spraying of orchards, and picking, packing, and shipping the fruit are especially considered, and notes given on the culture of cranberries, varieties of different fruits commonly grown in Nova Scotia, and on the Nova Scotia School of Horticulture and Fruit Growers' Association.

Special method for cleft grafting apples, pears, plums, and cherries, J. BORD (*Belg. Hort. et Agr., 11 (1899), No. 16, pp. 246, 247*).—The author advocates cleft grafting these fruits in September and October instead of in the spring, and notes the successful results obtained by himself in cleft grafting at this time.

The sand cherry as a stock, N. E. HANSEN (*Garden, 56 (1899), No. 1450, p. 176*).—Notes on the characteristics and value of this native western fruit as stock, with an account of the work in selection now being carried on with it at the South Dakota Station.

Pruning of trees and other plants, W. SAUNDERS (*U. S. Dept. Agr. Yearbook 1898, pp. 151–166.*)—A popular article discussing the general principles and practices of pruning and their specific application to the pruning of hedges, street trees, trees for timber, flowering shrubs, raspberries, blackberries, gooseberries, currants, apples, pears, plums, cherries, peaches, nectarines, and grapes.

Fertilizers for fruit trees (*Agr. Gaz. New South Wales, 10 (1899), No. 7, pp. 607–609*).—Fertilizer formulas for apples and pears, stone fruits, and citrus fruits.

Pears adopted by the Congrès Pomologique of France (*Garden, 55 (1899), No. 1440, pp. 440–442*).—A continued article. Complete pomological descriptions are given of a large number of varieties of pears.

The banana in cultivation and commerce, A. L. PINART (*Garden, 56 (1899), No. 1448, pp. 141, 142*).—Translated from *Bulletin de la Société d'Acclimatation.*

Camphor culture in Florida (*Florida Agr., 26 (1899), No. 35, p. 552*).—Notes on experimental plantings by private individuals in southern Florida, which have thus far yielded encouraging results.

Small fruits in 1897, G. C. BUTZ and J. P. PILLSBURY (*Pennsylvania Sta. Rpt. 1897–98, pp. 87–100*).—Variety tests and descriptive notes of strawberries, blackberries, currants, and gooseberries. In a comparative test of matted row and hill culture for strawberries, the hill system produced berries much more uniform in size, of finer flavor, and more highly colored. With the matted-row system fruit was from 1 to 6 days earlier and the plants remained in bearing from 1 to 4 days longer.

Utilizing surplus fruits, G. B. BRACKETT (*U. S. Dept. Agr. Yearbook 1898, pp. 309–316*).—This is a popular article treating in a practical way with the processes of drying or evaporation, canning, and extracting the juice of fruits. The treatment of the fruit by the several processes is described. Evaporation is considered the most economical process for the preservation of fruits. Among the minor points touched upon are the evaporation of cores and skins and the production of "chops," cider, orchard brandy, vinegar, fruit juices, unfermented wine, fruit sirups, and jellies. It is recommended that fallen fruit be utilized by turning the hogs into the orchard to forage upon it.

Artificial fertilization of coffee-tree flowers for the purpose of obtaining hybrids (*Planting Opinion, 4 (1899), Mar. 18; abs. in Rev. Agr. Réunion, 5 (1899), No. 7, pp. 319–321*).—Liberian coffee trees are recommended to be planted among Moka varieties to facilitate cross fertilization of the flowers by insect visits. The resulting hybrids are said to produce coffee of excellent flavor and a tree more resistant to diseases.

Tea from seed to cup in southern India, T. BROWN (*Planting Opinion, 4 (1899), Nos. 33, pp. 631, 632; 34, pp. 670, 671; 35, pp. 687, 688*).—The subjects of grafting, pruning, topping, picking the crop, removing blossoms, and the like are popularly considered.

Vanilla (*Queensland Agr. Jour., 4 (1899), No. 6, pp. 477–483, figs. 4*).—This article deals with the cultivation, pollination, fertilizing, and harvesting of vanilla; drying and preparing the pods for market, and the London prices for vanilla in 1898.

The present condition of grape culture in California, G. HUSMANN (*U. S. Dept. Agr. Yearbook 1898, pp. 551–562*).—This is a sketch of the rapid development of grape growing in California. It is believed that the industry is established on a firm basis and promises still greater development as the merits of California wines become known.

Subirrigation on vines by brush ditches, L. DEGRULLY (*Prog. Agr. et Vit., 16 (1899), No. 36, pp. 269–274, figs. 3*).—The details of making brush ditches and the advantage of using such ditches in connection with subirrigation by means of tiles are discussed at some length. Brush ditches when properly made last about 10 years. An instance is noted of a vineyard irrigated in this manner in which the least yield for 20 years in succession had been at the rate of 173 hectoliters per hectare and the greatest 183 hectoliters per hectare.

Resistant vines, G. HUSMANN (*Pacific Rural Press, 58 (1899), No. 14, p. 213*).—The author recites his experiences with different varieties of resistant grapes, and on this basis makes suggestions as to desirable varieties for planting for white and red wines.

Green manures in vineyards, DORRY (*Vigne Amer. et Viticult. Europe, 23 (1899), No. 9, pp. 281–283*).—The author discourages the use of green manures in vineyards, as the harm they do in taking up soil moisture more than counterbalances their fertilizing value.

Coloring grapes (*Garden, 55 (1899), No. 1439, p. 419*).—Directions for putting color and finish on ripening bunches of grapes. It is stated that the essentials to well-finished fruit are an abundant food and moisture supply at the roots, avoidance of overcropping, and a very liberal supply of fresh air night and day.

Notes on the self-fertility of cultivated grapes, S. A. BEACH (*Proc. Soc. Prom. Agr. Sci., 1898, pp. 162-167*).—The data of this article have also appeared in Bulletin 157 of the New York State Station (E. S. R., 11, p. 248).

Tests of methods of preserving fruits (*Gartenflora, 48 (1899), No. 17, p. 464*).—Fruit was (1) packed in turf dust in boxes and the boxes stored in a cellar; (2) in turf dust in boxes after being wrapped in tissue paper; (3) wrapped in tissue paper, packed in turf dust in boxes, and the boxes buried in the ground 18 in. deep, and (4) wrapped in tissue paper and laid on racks in a fruit storage cellar. Fruit thus preserved was exhibited at the agricultural fair held in Frankfurt, Germany, June 8-13, 1899. Wrapping in tissue paper and packing in turf dust gave the best results, all fruits considered; and this method is thought to be a valuable means of prolonging the keeping periods of desirable market fruits, especially apples.

The walnut, J. B. NEFF (*Pacific Rural Press, 58 (1899), No. 12, p. 182*).—Notes on the growing, pruning, and diseases of walnuts.

Cultivation of the English walnut (*U. S. Spec. Consular Rpts., 15 (1899), pt. 2, pp. 153-167*).—Notes on the culture, yield, and exports of English walnuts to the United States from Austria-Hungary, France, Germany, and Italy.

Commercial chestnut culture in the United States, G. H. POWELL (*Amer. Gard., 20 (1899), Nos. 220, pp. 178, 179, fig. 1; 223, pp. 238, 239, fig. 1; 225, p. 280; 226, pp. 295, 296, figs. 2; 235, p. 444; 242, p. 559, figs. 2*).—A general discussion of the history and present status of the industry in the United States, types of cultivated chestnuts, chestnut culture, and varieties.

The improvement of plants, A. HEMSLEY (*Gard. Chron., 3. ser., 26 (1899), No. 662, pp. 186, 187*).—The author's experience in the improvement of mignonette, Chinese primulas, cinerarias, pelargoniums, begonias, and carnations is given in more or less detail.

Centaurea ragusina, H. T. MARTIN (*Gard. Chron., 3. ser., 26 (1899), No. 664, p. 223*).—Culture notes.

Decorative and cactus dahlias, L. BARRON (*Amer. Gard., 20 (1899), No. 247, pp. 638, 639, figs. 3*).—Discussion of the characteristics of these two classes of dahlias.

Commercial fertilizers in the culture of geraniums, V. BOUTILLY (*Rev. Cult. Coloniales, 5 (1899), No. 37, pp. 177-179*).—The yields of geranium essence obtained on 9 plats differently fertilized are tabulated and discussed. Superphosphate of lime proved the most efficient fertilizer of the different materials employed.

Perfumes from plants, F. W. BURBRIDGE (*Garden, 56 (1899), No. 1444, pp. 59-62*).—A catalogue of the plants most generally grown for their fragrance, and especially of those having sweet-scented leaves as well as flowers.

Hybridization, F. A. WAUGH (*Amer. Gard., 20 (1899), No. 234, pp. 431-435, figs. 4*).—This paper contains a catalogue of important hybrids among ornamental plants and fruits, the author's statement of the general laws of hybridity and of hybridism, and practical suggestions to plant breeders.

Bulb growing in the State of Washington, A. SIMON (*Amer. Florist, 14 (1899), No. 576, pp. 1357, 1358; Florists' Exchange, 11 (1899), No. 24, p. 626*).—Experiments in raising flowering bulbs have been carried on for 6 to 8 years at Orcas Island, San Juan County, Wash., with results indicating that the soil and climatic conditions of this region are adapted to the industry. Western Washington is said to have plenty of moisture in the growing season, a period which extends usually from October to the July following, and the ground rarely freezes to the depths the bulbs are planted. This is followed by a rainless period of 60 to 90 days in mid-season. The bulbs are found to mature in a remarkably short time. This is believed to be due to the facts that from the time the bulbs are planted or commence their fall growing until after the blooming period, there is no cessation in growth on account of frost, and that the bulbs get thoroughly ripened off before the growing period commences again. It is stated that larger and better developed blooms and 50 per cent more stock is obtained than in Holland.

Causes of imperfect or deformed flowers in Bermuda lilies, A. F. WOODS (*Gardening, 7 (1899), No 163, p. 297*).—The development of brown sunken spots on the petals is stated to be due to weak bulbs. Splitting of flowers on one side is often caused by the work of the aphis on young buds of plants which have been forced rapidly.

Orchid roots (*Garden, 56 (1899), No. 1442, pp. 21, 22*).—Notes on the habits of growth of roots of various orchids.

A monograph of Cypripedium, F. DES BOIS (*Les Cypripedium; leur monographie. Gand: E. Meyer, 1898, pp. 544*).—This is said to be a work essentially for gardeners, being rather a voluminous compilation than a systematic study. The names and descriptions are generally given as originally published without an attempt to discriminate synonyms.

Soil vs. climate in the culture of roses (*Gard. Chron., 3. ser., 25 (1899), No. 633, p. 81*).—It is contended that climate has far more to do with the successful culture of the rose than does the soil. This opinion is supported by arguments drawn from the culture of the plant in a number of localities in the British Isles and on the Continent.

History of the sunflower, ROZE (*Jour. Soc. Nat. Hort. France, 3. ser., 21 (1899), June, pp. 505–512*).—Extensive historical notes

Early sweet peas, R. T. BROTHERSTON (*Gard. Chron., 3. ser., 25 (1899), No. 636, p. 132*).—Notes on numerous varieties.

Shading violets, P. H. DORSETT (*Amer. Florist, 14 (1899), No. 576, p. 1364*).—It is recommended that violets be shaded from the time they are set out until October. The light should be strong but well diffused during the growing season.

The Kei apple (Aberia caffra), F. M. BAILEY (*Queensland Agr. Jour., 4 (1899), No. 6, p. 468, pl. 1*).—Botanical, cultural, and culinary notes. The plant is recommended for hedge making.

Moving large trees without a wagon, E. ANDRÉ (*Rev. Hort., 71 (1899), No. 14, pp. 325–328, figs. 4*).—The method consists in lifting the tree from the ground by means of derricks, mounting on rolls, and moving as a building is moved. The method is especially adapted for use on hillsides and wet ground.

FORESTRY.

Notes on some forest problems, G. PINCHOT (*U. S. Dept. Agr. Yearbook 1898, pp. 181–192, pls. 1*).—The author briefly mentions some of the phases through which the public estimation of forestry has passed, introductory to a short discussion of what he believes to be the true character and proper field of forestry in the United States. At first, forestry was understood to relate to trees, but more to the individual tree than to forests. The economic management of forests and conservative lumbering is a more recent understanding of the subject, and to this must be added the effect of forests on the water supply.

The subject as described by the author may be divided into two divisions: Forestry in wooded regions, and in the treeless regions. In the wooded regions, forestry has to do with the protection and preservation of forests, but, most of all, with their use. In the drier regions of the West, the duties of the forester include the protection of the mountain forests, not only for the purpose of wood, but also on account of the effect of forests on the water supply, and also tree planting in the plains and treeless valleys.

The work that the Government is carrying on in forestry is briefly outlined, and some of the obstacles to conservative lumbering are stated. Among these obstacles the principal ones are lack of definite information and the effect of heavy taxes on forest lands. The subjects of forest grazing, tree planting in the plains, and forest fires are briefly reviewed.

Influence of spacing on the growth of certain trees, A. JOLYET (*Bul. [Min. Agr. France] 18 (1899), No. 2, pp. 286–291*).—The author reports the effect of planting spruce, pine, and larch trees at distances of 1, 1½, and 2 meters apart. The trees when planted were 3 and 4 years old, and the measurements were made in the spring of 1898 after having been planted from 12 to 14 years. The average spread ot the different trees, their circumference, and height are given. It appears from the figures given that a distance of about 2 meters gives the best results, especially with spruce. This distance seems particularly to favor increase in diameter. The effect on height is not definitely shown.

The restoration of mountain covering, T. P. LUKENS (*Forester, 5 (1899), No. 7, pp. 151–155*).—The author comments upon the trees available for the restoration of mountain covering in southern California, and describes their characteristics, growth, and habitat. Of the trees best suited to this purpose the tuberculated or knobcone pine (*Pinus tuberculata*) is considered especially available on account of some of its peculiarities of growth. The habit of the tree in holding its cones for many years, or, in fact, until the death of the tree, when the seeds are liberated, renders it peculiarly adapted to reforesting burned areas, and it is in these regions that the tree seems to be most abundant.

Another tree which is well adapted to this purpose is the *Sequoia gigantea*, and an instance is cited in which Sequoia seeded simultaneously with pines, firs, and Libocedrus after about 7 years had attained a marked advantage in growth over the others. Among other trees adapted to mountain covering the author mentions the silver firs (*Abies concolor* and *A. magnifica*) and the silver pine (*Pinus ponderosa*).

Growing forest-tree seedlings, W. B. ALWOOD and J. L. PHILLIPS (*Virginia Sta. Bul. 88, pp. 15–55*).—The horticultural department of the station has for a number of years been growing forest and ornamental trees for resetting in the campus and station grounds. In 1896 cooperative experiments were undertaken in connection with this Department in which it was desired to study the effect of climate on several species of forest trees grown from seeds collected from different parts of the country. The species tested were black walnut, bur oak, hackberry, honey locust, boxelder, green ash, and white ash. The more important data concerning the growth of the different species during the 2 years in which the experiments were conducted are given in tabular form. While no very constant differences due to change of locality are observed, in some cases the trees grown from southern seed were considerably longer in maturing in the fall and consequently were more injured by frost.

It is stated that the growing of forest-tree seedlings may be easily accomplished. Seeds of the silver maple or other early-ripening species must be gathered and sown at once. The late-ripening species should be sown in autumn or stratified and planted in the spring. All forest-tree seedlings should be grown in mellow loam soil so as to encourage the development of a strong root system, and transplanting should be made at the end of the first or second year into nursery rows. Most forest trees should be permanently planted when they have attained a height of from 5 to 8 ft.

The redwood forests of California, H. GANNETT (*Forester*, *5* (*1899*), *No. 7*, *pp. 148-150*, *figs. 2*).—The author describes the redwood (*Sequoia sempervirens*), its distribution throughout the Pacific coast, and the extent of its forests. The tree is said to be, to a considerable degree, exempt from injury by forest fires on account of the small amount of resin contained in the wood. Where the redwood forests have been cut off but few seedlings are found, and the author states that probably by the progressive drying of the climate the environment is not now favorable to the growth of the redwood, and with the clearing away of the present forests the lumber value of this species will disappear.

The Douglas spruce in northern Oregon, H. S. GRAVES (*Forester*, *5* (*1899*), *No. 3*, *pp. 52-57*, *pls. 2*).—The Douglas spruce is said to be found from tide land to an elevation of between 5,000 and 6,000 ft. above sea level. Scattering trees occur near the coast but only begin to reach their normal development above the recent sea deposits. On the eastern side of the Cascade Range the author has not observed the tree at a less elevation than 2,800 ft. In Washington and Oregon the Douglas spruce is probably the most rapid growing of coniferous trees, and the author summarizes a number of measurements made during 1896 to ascertain the rate of growth and reproduction.

Notes are given on the habit of the tree, its tolerance toward shade, reproduction, and growth. When growing in open situations Douglas spruce develops a large spreading crown, which gives the tree a broad, conical aspect. In dense stands, however, the trees are very tall, shed their lower branches early, and form long, clear boles with narrow compact crowns. The largest tree measured by the author was 13 ft. in diameter and was estimated to be over 300 ft. in height. While there is no apparent difference botanically between them, lumbermen recognize 2 types of spruce—a red and a yellow. The author states that yellow spruce is old and mature and generally found in dense forests, on good soil, and in favorable situations. The trees have long, clear, full trunks, narrow crowns, and a fine-grained, yellowish wood. The red spruce has a comparatively large crown, deeply corrugated bark, and coarse-grained, reddish wood. For the most part the red spruce is found on the eastern slope of the Cascades while the yellow variety is confined to the Pacific slope.

From tables in which average measurements of a number of plats are given it appears that the tree reaches its maximum rate of growth in height between its twentieth and thirtieth years, during which period it is shooting up 2.4 ft. per year. The mean annual growth in height for the first 30 years is 1.9 ft.; the rate of growth in diameter is very regular; it reaches its maximum about its thirtieth year and continues at the rate of 0.24 in. per annum until the tree is about 50 years old, after which the rate decreases. From the figures given, a fully stocked plat should contain between 2,000 and 3,000 twenty-year-old trees per acre. With the increased growth the number of trees decreases until at the age of 83 years one plat contained 150 trees, which is about 0.7 that of a fully stocked area. The annual increase of growth in such a forest is a little more than 2 cords per acre.

Work of the Division of Forestry for the farmer, G. Pinchot (*U. S. Dept. Agr. Yearbook 1898, pp. 297–308, pls. 3, figs. 2*).—The Division of Forestry, in its relation to the farmer, has two important lines of work, namely, the introduction of suitable trees for planting in the treeless portions of the West and the better handling of wood lots on farms in the regions where trees now grow. The Division of Forestry has undertaken to give practical advice as how best to secure the advantages of proper management and a copy of the agreement between the Department and the owner of a wood lot is given. The working plan for a wood lot at Oakland, N. J., is appended.

The profession of forestry, G. Pinchot (*Forester, 5 (1899), No. 7, pp. 155–160, pls. 4*).—An address delivered before the students of Yale University.

The need of forestry experiment stations, W. R. Lazenby (*Proc. Columbus Hort. Soc., 13 (1898), pp. 15–17*).—A popular address on forestry.

Forestry experiment stations, Loren (*Allg. Forst u. Jagd. Ztg., 65 (1899), No. 4, pp. 113–121*).—An address outlining the organization of forestry stations in Germany and briefly summarizing their investigations.

Forestry in the United States (*Mitt. Deut. Landw. Gesell., 11 (1899), No. 11, Beilage, pp. 50–56*).—A résumé is given by the German Embassy of the forests and forestry conditions of the United States.

Forest administration in Bengal, E. G. Chester (*1897–98, pp. 90*).—A report is given on the extension and constitution of the State forests, their management, gross yield and output of forest produce, financial results, forest administration, etc. Under the subject of management of State forests, working plans are discussed, and the general subject of forest protection, improvement, and exploitation is considered in detail.

Forestry in New South Wales, W. S. Campbell (*Rpt. Australasian Assoc. Adv. Sci., 7 (1898), pp. 958–961*).—The author reviews the forestry conditions of New South Wales, calling attention to some of the valuable timber and also the necessity of its proper conservation.

On the forests of Dean, F. Bailey (*Trans. Roy. Scottish Arbor. Soc., 15 (1898), pt. 3, pp. 292–300*).—Extracts are given from a report by H. C. Hill on the above forests, in which the working plan for high meadow woods is outlined and suggestions given for the management of the forest as a whole.

Establishment of State model forests for Scotland, F. Bailey, R. C. Munro Ferguson, and R. Galloway (*Trans. Roy. Scottish Arbor. Soc., 15 (1898), pt. 3, pp. 201–222*).—A letter addressed to the president of the Board of Agriculture, setting forth the views of the society on this subject.

Working plan for the forests of the Raith Estate, F. Bailey and G. U. MacDonald (*Trans. Roy. Scottish Arbor. Soc., 15 (1898), pt. 3, pp. 223–278; Summary in Trans. Highland and Agr. Soc. Scotland, 5. ser., 11 (1899), pp. 115–121*).—Gives working plans for the management of the forest in the interest of the charcoal production. This is said to be the first plan put into operation in Scotland.

The relation of forest preservation to the public welfare, J. B. COLLINS (*Forester, 5 (1899), No. 6, pp. 127–129*).—An address before Montana State University.

What shall we do for the forest? (*Forester, 5 (1899), No. 6, pp. 129–133*).—A symposium of 4 papers on this subject, as follows: An object lesson of forest destruction, E. L. Berthoud; The need of forest legislation in Colorado, H. Michelsen; The advisability of forest culture, and The increasing interest in forest preservation.

The lumberman's view of the forest (*Forester, 5 (1899), No. 6, pp. 133–135*).—Two papers—(1) Forest destruction, H. B. Ayres, and (2) Conservation, E. M. Griffith.

Trees in cities and some of the causes of their destruction, P. NYPELS (*Ann. Soc. Belge Micros., 23 (1898), pp. 75–143, pl. 1*).

On the influence of cutting and different degrees of light upon the stand of forest trees, SCHWAPPACH (*Ztschr. Forst u. Jagdw., 31 (1899), No. 5, pp. 259–293*).

The decay of trees, A. C. FORBES (*Gard. Chron., 3. ser., 26 (1899), No. 656, p. 66*).—Notes are given on some of the causes of decay in forest trees. That decay is often not an immediate cause of the death of the tree is shown by citing examples of oaks and yews known to be more than 1,000 years old, although nothing remains of the tree trunk but a shell. It is stated as a fact that almost all examples of very old trees are either pollards or pollard-like in their stem and growth. The commercial value of clean boled sound trees, greater liability to destruction by winds, and tendency to weakening of root system are given as causes of the destruction of many trees.

The basket willow, E. HERSEY (*Bul. Bussey Inst., 2 (1899), pt. 8, pp. 429–436*).—Gives an account of experiments on the cultivation of *Salix purpurea* and *S. viminalis* for basket osiers, etc. Directions are given for the preparation of the soil, planting, cultivation for various purposes, and methods of handling the crop. It is also stated that many of the roots possessed no root hairs, but seemed to be enveloped in mycelium. From this it is thought the plant lives, partly at least, through the symbiotic action of the mycorrhiza.

Some timber trees of Queensland, J. W. FAWCETT (*Queensland Agr. Jour., 4 (1899), No. 5, pp. 382–387, pls. 3*).—Notes are given describing a number of species of Casuarina and giving their distribution and uses.

A short key to the hitherto known species of Eucalyptus, J. G. LUEHMANN (*Rpt. Australasian Assoc. Adv. Sci., 7 (1898), pp. 523–536*).—A key is given for the more ready determination of the 140 species of this important timber tree of Australia.

A review of the characters valuable for the classification of the Eucalyptus, R. TATE (*Rpt. Australasian Assoc. Adv. Sci., 7 (1898), pp. 544–552*).—The author reviews the various systems of classification that have been adopted and gives an arrangement of the species based on the shape and structure of the fruits.

The mesquite tree and its pods, T. STEEL (*Rpt. Australasian Assoc. Adv. Sci., 7 (1898), pp. 946, 947*).—A brief note is given calling attention to the mesquite (*Prosopis dulcis*) and its pods and analyses are given of samples, comparisons being made with pods from the honey locust, *Gleditschia triacanthos*.

Recent investigations in Prussia in regard to the quality of timber, W. SOMERVILLE (*Trans. Roy. Scottish Arbor. Soc., 15 (1898), pt. 3, pp. 279–291*).—This is a translation of a portion of A. Schwappach's work upon this subject and treats of the investigations made of the specific gravity and resistance to crushing of timbers grown in Prussia. In all, timber from 263 trees was studied, the varieties being Scotch fir, Norway spruce, silver fir, white pine, and beech.

Natural reforestation in the Southwest, J. W. TOUMEY (*Forester, 5 (1899), No. 7, pp. 145–147, fig. 1*).—The author calls attention to some of the problems to be considered in the southwestern portions of the United States, particularly California and Arizona, where the denuded lands may be gradually covered with tree growth. Several instances are cited in which through natural agencies this has been secured, and the successful reforestation in this region will depend largely upon the prevention of forest fires and close cropping by stock, particularly sheep.

Fourth annual report of the chief fire warden of Minnesota, C. C. ANDREWS (*1898, pp. 148, pls. 24*).—A statement is given on the practical working of the Minnesota fire-warden law. During the year covered by the report there were 51 forest fires and 67 prairie fires reported. Of the former, 78 per cent were extinguished by the State officers. The present condition of the forests in a number of counties of the State is pointed out, and their ultimate value, if properly managed, is shown.

The report contains summaries showing the condition of a number of private forests in this country and the forestry conditions in a dozen or more European States.

Forestry legislation of Switzerland (*Bul. Soc. Cent. Forst. Belg., 6 (1899), No. 7, pp. 435-441*).—A brief summary of the Swiss laws relating to forestry.

The Massachusetts Forestry Association, A. CHAMBERLAIN (*Forester, 5 (1899), No. 10, pp. 219-221*).—Notes the organization and aims of this association.

SEEDS—WEEDS.

Effect of alkali on seed germination, J. STEWART (*Utah Sta. Rpt. 1898, pp. XXVI-XXXV, dgms. 8*).—As a part of the preliminary work on the study of alkali problems, the author conducted a series of experiments with wheat, oats, rye, barley, alfalfa, peas, and red and white clover, to test the effect of different amounts and different kinds of alkalis upon their germination. Shallow tin plates containing 400 gm. of sand were prepared, to which were added varying quantities of carbonate of soda solution representing a percentage of alkali ranging from 0.05 to 4 per cent. In another lot sodium sulphate and in a third sodium chlorid were substituted for sodium carbonate. In general it was noted that the sodium sulphate is less injurious than either of the other alkalis, but in nearly every case 1 per cent of the white alkali was fatal to germination. With the white and red clovers white alkali proved as injurious as the black. Although sodium carbonate is conceded to be the most injurious of the three compounds tested, the chlorid, in its injurious effects, stands very close to it. In every case but one 0.5 per cent of either carbonate or chlorid proved fatal to germination.

In reference to their ability to withstand alkalis, the cereals generally surpassed the legumes, although peas are nearly as hardy as the cereals, and in black alkali proved stronger than either wheat or oats. In their germinative power the cereals stand in the following order: Oats, wheat, rye, and barley, oats being the weakest. This relation holds good for all three kinds of alkali tested. The relative power of the legumes to resist effects of different alkalis varies slightly. In the black alkali the relation was: Alfalfa, white clover, red clover, and peas, the alfalfa being the weakest. With the sodium sulphate and sodium chlorid the relation is the same, except that the alfalfa and white clover change places. It was further found that alfalfa is able to withstand the effects of large amounts of sodium sulphate better than red clover, although with small amounts of sulphate the red clover appeared the stronger. It is stated as worthy of mention that even in soils free

from alkali the alfalfa and white and red clovers exhibited a much smaller power of germination than either of the other kinds of seeds. The author states that the results of this preliminary experiment would simply indicate that cereals would prove a much surer crop on alkali soils than legumes.

The effect of ferments on the germination of old seed, A. THOMSON (*Gartenflora, 45 (1896), p. 344; abs. in Centbl. Agr. Chem., 28 (1899), No. 5, p. 352*).—A report is given of experiments on the germination of a number of cereals taken from the economic collection of the University of Dorpat, these seeds being from 20 to 25 years old. They were divided into lots of 100 each and soaked for 24 hours in diastase or pepsin solutions, after which they were well washed with distilled water and germinated. The pepsin and one of the diastases were commercial preparations, and the second diastase was extracted from freshly germinated barley.

The experiments showed that barley which gave a germination of 4.5 per cent germinated 35 per cent when treated with a 5 per cent diastase solution and 48 per cent with a 10 per cent diastase solution. A 5 per cent pepsin solution raised the percentage of germination from 4.5 to 10 per cent. Oats which had a germination of 16 per cent germinated 47 per cent when treated with a 5 per cent diastase solution and 54 per cent with a 10 per cent disastase, while a 5 per cent pepsin solution increased the germination to 39 per cent. A small-grained maize, which possessed a germinative energy of 3 per cent, germinated 49 per cent when treated with a 5 per cent diastase solution and 38 per cent with a 5 per cent pepsin solution. Rye and wheat which showed no germination when soaked in water gave no indication of germinating after treatment with the ferments. Peas which germinated 5 per cent germinated 22 per cent when treated with a 5 per cent diastase solution. White clover when untreated germinated 17 per cent, and 50 per cent when soaked with a diastase. Yellow clover with a germination of 7 per cent gave 13 per cent when treated with diastase.

Report of the seed-control station in Lund (Sweden) for the year 1898, B. JONSSON (*Malmö, 1899, p. 19*).—The report presents the usual account of the work done in analyzing seed samples, of which 1,621 were examined during the year. An investigation of the influence of the germination bed on the germination of seeds is also reported. The Jacobsen germination apparatus (E. S. R., 10, p. 12) was used. The highest results were obtained for all seeds tested when the disks of felt were sterilized, put on warm, and changed daily, the paper being left unchanged. When the felt disks were changed as before and the filter paper changed every fifth day, somewhat lower results were obtained, viz, for *Dactylis glomerata* 89.6 per cent against 97.2 per cent, for *Festuca rubra* 74 per cent against 85.2 per cent, for timothy 72.2 per cent against 80.8 per cent, etc. When neither felt disks nor filter paper were changed, the germination of the seeds mentioned was 88, 40, and 74 per cent, respectively.—F. W. WOLL.

The eradication of charlock (*Jour. Bd. Agr.* [*London*], *6* (*1899*), *No. 1, pp. 17–21*).—A report is given of a number of experiments conducted in various parts of England for the eradication of charlock (*Sinapis arvensis*). In several of the experiments the effect of 1 to 6 per cent solutions of copper sulphate in qualities varying from 10 to 100 gal. per acre was tested on fields of barley and oats. It seems from these experiments that copper sulphate will destroy the charlock without injury to the cereal crops or seeds sown with them, such as vetches and mangels. The strength of solution, it is said, should not exceed 2 per cent, and from 25 to 50 gal. per acre should be applied. Similar experiments were conducted in which sulphate of iron was applied in strengths of 13 to 20 per cent to an oat field. The charlock was destroyed by this treatment, although it is thought that the strengths of solutions were too strong to be used on a large scale. Whichever method of treatment is adopted, 1 or 2 applications should be made while the cereal crop is quite small. The solutions may be sprayed by hand, but experience has shown that horsepower sprays are more economical. The application should be made during fine weather, when there is no immediate prospect of rain, and a second application, following the first by a short interval, will frequently be found advantageous.

Experiments in which the charlock was in full flower among oats 18 in. high were unsuccessful. At this time 4 per cent solutions of copper sulphate at a rate of 50 gal. per acre did not kill all the flowers, the weeds being protected to a considerable extent by the oat plants.

Experiments on charlock spraying in 1899, J. HORNSBY (*Agr. Gaz.* [*London*], *50* (*1899*), *No. 1314, p. 232; Farm and Home, 18* (*1899*), *No. 918, p. 335*).—An account is given of a series of experiments conducted upon two fields of barley for the eradication of charlock (*Sinapis arvensis*), in which solutions of copper sulphate and iron sulphate were tested, different quantities and strengths of solutions being compared. The iron sulphate was used in strengths of 7½ and 10 per cent at the rate of from 32 to 40 gal. per acre without effect. The solutions of copper sulphate used were 2, 3, 4, and 5 per cent, the quantity employed varying from 16 to 40 gal. per acre. The first series of experiments were made when the plants were just beginning to show the flower buds. Many of the plants at this time were quite small, possessing only five or six leaves. Another series of experiments was conducted later, in which 2 and 4 per cent solutions of copper sulphate at the rate of 72 and 85 gal. per acre were sprayed over the fields when the charlock was coming into flower, and a still further lot was sprayed with 72 gal. of a 4 per cent solution to test whether the weed would be killed when forming its seed, and also to ascertain the effect on white clover which had been sown with the barley.

In all these experiments the copper sulphate treatment was very efficient, fully 85 per cent of all plants of charlock being destroyed without any permanent injury to the barley or clover. As a result of these experiments the author recommends spraying charlock at the rate of 40 gal. per acre with a 2 per cent solution when the plants are small, or, if the charlock is in full flower, at the rate of 60 gal. per acre with a 4 per cent solution. The quantity to be used was also found to vary with the atmospheric conditions at the time of spraying.

Grass seed and its impurities, G. H. HICKS (*U. S. Dept. Agr. Yearbook 1898, pp. 473–493, pls. 5, figs. 2*).—The author points out some of the difficulties met with in securing good grass seed and suggests various ways in which the quality might be improved. Illustrated descriptions are given of a number of the more common grass seeds and the impurities usually accompanying them. Among those described are Kentucky blue grass, rough-stalked meadow grass, wood meadow grass, timothy, orchard grass, fescues, English rye grass, awnless brome grass, meadow foxtail, redtop, and bent grasses.

Seed testing and selection, J. ATKINSON (*Breeders' Gaz., 35 (1899), No. 16, p. 483*).—Brief directions for seed testing and selection.

Report of seed testing during 1898, BEINLING (*Wchnbl. Landw. Ver. Grossherz-Baden, 1899, No. 10, pp. 122–125*).

Effect of inductive electricity on the germination of seed, F. E. AHLFVENGREN (*Öfvers. K. Svenska Vetensk. Akad. Forhandl., 1898, No. 8, pp. 22, fig. 1; abs. in Bot. Centbl., 79 (1899), No. 2, pp. 53, 54*).—Experiments with a large number of seeds of economic plants showed that electricity exerted a beneficial influence on the germination of many varieties. Old seed and those requiring a long time for germination were either not influenced at all or very slightly. In accordance with the conclusions of Kinney (E. S. R., 9, p. 54), maximum, minimum, and optimum strengths of current were observed.

Weeds in cities and towns, L. H. DEWEY (*U. S. Dept. Agr. Yearbook 1898, pp. 193–200, figs. 5*).—The characteristics of city weeds are pointed out, and among those most widely dispersed are the cocklebur, tall ragweed, rough pigweed, burdock, and fine-leaved sneezeweed (*Helenium tenuifolium*). Some of the effects of weeds are mentioned and suggestions given for their eradication.

Eradicating the Canada thistle, T. SHAW (*Breeders' Gaz., 35 (1899), No. 26, pp. 776, 777*).—Salting and repeated cutting recommended for its eradication.

The life history of Cuscuta, G. WILSDORF (*Fühling's Landw. Ztg., 48 (1899), Nos. 14, pp. 544–550; 15, pp. 561–567*).—Investigations are reported on the germination, experiments with seedlings, methods of attacking host plants, haustoria, vegetative growth, and reproduction of a number of the more common economic species of Cuscuta.

Dodder affecting alfalfa, E. SCHRIBAUX (*Prog. Agr. et Vit. (Éd. L'Est), 20 (1899), No. 34, pp. 229–236; Rev. Gén. Agron. [Louvain], 8 (1899), No. 8–9, pp. 373–377*).—The author describes *Cuscuta gronovii* and states that it is frequently present in American clover and alfalfa seed.

Spraying for mustard, F. T. SHUTT (*Canad. Hort., 22 (1899), No. 9, pp. 345–347*).—Notes the effect of comparatively strong solutions of fungicides on this weed.

DISEASES OF PLANTS.

Work in vegetable physiology and pathology, A. F. WOODS (*U. S. Dept. Agr. Yearbook 1898, pp. 261–266*).—A brief review is given of the investigations carried on by the Division of Vegetable Physiology and Pathology. Among some of the more important results which have been ascertained, mention is made of the three-years' test for rust resistance of some 900 varieties of wheat. The varieties found to be most resistant to orange leaf rust are the winter wheats Turkey, Mennonite, Pringle No. 5, Rieti, and Odessa, and the spring wheats Haynes Blue Stem and Saskatchewan Fife. The Durum and Poulard wheats are said to be very resistant to rust, but, on account of their high gluten content, are so far mainly used for macaroni. In this investigation it has been found that the leaf rusts which have been chiefly hitherto studied are not nearly so destructive to the crops as the black stem rusts of wheat and oats. It has been further demonstrated that the uredo or summer stage of *Puccinia rubigo-vera tritici* lives over the winter, and the same has been proved true of the corresponding form on rye. The black stem rust of wheat is said to occur on squirrel-tail grass (*Hordeum jubatum*), but, so far as known, does not winter in its uredo form in this country. Orchard grass and tall oat grass are now known to be hosts for the black stem rust of oats, and, as a consequence, the oat crop may be infected from these grasses. A full presentation of this and other investigations is promised shortly.

In addition to the work on rusts mention is made of a number of other important diseases, among them investigations on a destructive disease of bulbs on the Pacific Coast; sooty mold of the orange and lemon, which follows attacks of the mealy wing or white fly and may be combated by parasitic fungi; leaf-spot disease of violets; and studies in plant breeding.

Rice blast and a new smut on the rice plant, A. P. ANDERSON (*South Carolina Sta. Bul. 41, pp. 14, figs. 1*).—Numerous inquiries received from various sources led the author to investigate the cause of blast or blight of rice. Most of the information given in the bulletin is from correspondence with a number of the leading rice growers of the State. The disease characterized as blast or blight seems to be manifest in two forms. According to one correspondent the rice-stalk borer is probably the cause of one form of the disease, while the other is apparently of unknown cause. Both diseases attack the upland as well as lowland rice, frequently damaging the crop to a very considerable extent. Another correspondent divides the disease into what he designates as "direct" and "indirect" blast. The first is characterized by the heads appearing dead when emerging from the sheath. The second form is less easily distinguished, and will probably not be recognized until the rice, instead of being of a bright golden color, is seen to be assuming a dark tan appearance. This latter form seems to be due to imperfect aeration of the roots, and was in one case corrected by withdrawing the water from the crop and thoroughly draining the land. The direct blast, from the symptoms given, the author believes to be due to a fungus, which will require further study.

Samples of rice flower, much darker than normal, were submitted to the author for an opinion as to the cause, and upon examination it was found that the flour contained large numbers of black spores. A study of these spores proved them to be *Tilletia corona*, a species of smut described first as occurring on species of grass near Washington, D. C. Comparisons are made between this fungus and *T. horrida* from Japan, from which the author is led to believe that the two are apparently identical. The different characters of the fungus spores are given, and the author expresses the belief that the infection takes place through the young seedlings being affected as soon as the seed germinates. There appears to be no record showing that rice has ever been treated with fungicides, but the author suggests that possibly the treatment given for the prevention of wheat and oat smuts would be beneficial in preventing this disease.

A preliminary report upon treatment for rice smut, E. WALKER (*South Carolina Sta. Bul. 41, pp. 15–31, fig. 1*).—A report is given upon a number of experiments made to test the effect on rice seed of various treatments which were expected to prove beneficial in preventing attacks of the rice smut. All attempts made to germinate the spores have thus far failed, and the effect of the treatment upon them is inferential from that which results in treating oats and wheat.

In experiments made, two series of vessels containing the seeds for germination were arranged, and the seeds were soaked in one-half per cent solution of copper sulphate, 1 per cent solution of potassium sulphid, ½ per cent solution of bromin water, ½ per cent solution of formaldehyde, scalded 3 seconds in boiling water, and then soaked 24 hours in cold water. Two additional lots were also soaked 24 hours in cold water and soaked 24 hours in a 1 per cent solution of pyoktanin. The effect of these various treatments on the germination and subsequent growth is stated, from which it appears that the treatment did not in any way interfere with the germination, and in the case of the bromin water it was thought to slightly accelerate it. A number of the treatments caused rather a feeble and weak growth after germination. This was particularly true of soaking in a solution of pyoktanin and copper sulphate. As a preliminary to this experiment, the author separated the heavy seed from the light and diseased ones by throwing them in water, and he recommends this as one of the treatments to be adopted for the prevention of the smut. Until definite information is known concerning the effect of these fungicides upon the spores, no positive recommendations can be made.

Bacteriosis of potatoes occurring near St. Petersburg in 1898, K. S. IWANOFF (*Ztschr. Pflanzenkrank., 9 (1899), No. 3, pp. 129–131*).—The author notes having observed in July, 1898, that the stems and leaves of many potato plants were affected, the stems showing brown streaks and patches and the leaves becoming wilted and brown. The disease first manifested itself upon the leaf blades and later the stems were affected. By August 15 it had spread quite widely and the crop in the affected fields was greatly diminished, the tubers being small and few.

A study of the disease led the author to the conclusion that it was due to bacteria and he isolated small, short, oval-cylindrical, active bacteria, 1.5μ by 0.5μ in size. Numerous other organisms were found but they were mostly if not all believed to be saprophytic. Among them are enumerated *Fusarium solani*, *Rhizoctonia solani*, *Verticillium albo-atrum*, several bacteria, and yeasts.

Attention is called to the great similarity existing between this disease and its cause and that described by Smith in Bulletin 12 of the Division of Vegetable Physiology and Pathology of this Department (E. S. R., 8, p. 895) as due to *Bacillus solanacearum.* The investigations have not been carried far enough to establish their identity.

The presence of the cucurbit wilt due to *Bacillus tracheiphilus* (E. S. R., 7, p. 311) and *Cercospora resedæ* on *Reseda odorata* are affirmed. Both proved very injurious to their host plants.

The parasitism of yeasts in relation to sorghum blight, RADAIS (*Compt. Rend. Acad. Sci. Paris, 128 (1899), No. 7, pp. 445–448*).—After briefly quoting the position of several investigators relative to the cause of sorghum blight, the author states that stems of sorghum affected with blight were received from Algeria, from which a small ovoid budding yeast was separated and cultivated in a pure state. The yeast, which is a true saccharomycete, was cultivated on various media and its characteristics are given. Sorghum plants which were grown in the greenhouse and inoculated with cultures of this yeast presented the characteristic appearance shown by sorghum blight. The investigations show that the yeasts are able to develop in the living cells of sorghum and produce the red color characteristic of sorghum blight in the tissues of the plant.

The author believes that the results of his experiments confirm the hypothesis of Palmeri and Comes that the sorghum blight is due to the parasitic action of some saccharomycete. At the same time it is said that these investigations do not necessarily disprove those of Burrill, Kellermann, and Swingle who have claimed that the disease was due to bacteria, but merely show that yeasts may also be considered as a cause of sorghum blight. The red coloration exhibited in the disease is claimed to be due to the chromogenetic function of diseased cells.

Concerning the prevailing Monilia epidemic of fruit trees, FRANK and KRÜGER (*Landw. Jahrb., 28 (1899), No. 1–2, pp. 185–216, pls. 3*).—The authors give an account of a serious outbreak of *Monilia fructigena* on various fruit trees, it having been especially destructive to cherries. A description of the fungus and its appearance on different fruit trees are given. The various tissues attacked are mentioned and the behavior of the fungus in them described. The relation between weather, soil, and exposure, and the disease are discussed at some length, as is the life history and development of the fungus. Historical and geographical notes are given relative to the outbreak of the epidemic. A related and sometimes associated fungus, *Clasterosporium amygdalearum*, is also described. Notes are given on experiments for the prevention of the disease. The authors recommend collecting all mummified fruits and other refuse, pruning all dead twigs, and burning this refuse. Thorough spraying with Bordeaux mixture or similar fungicides is advised, and the ground under diseased trees may be dusted with lime to considerable advantage.

Brown rot of prunes, A. B. CORDLEY (*Oregon Sta. Bul. 57, pp. 15, figs. 7*).—A report is given upon a serious disease of prunes caused by the brown rot (*Monilia fructigena*). This fungus, which is known upon a number of other hosts, is described and some of the differences as manifested on the prune are pointed out. In the case of its attack upon cherries and peaches, a small circular brown spot is said to appear at the point of infection, and this rapidly spreads until the whole fruit becomes affected. In apples, pears, and quinces, the disease spreads in much the same way, but more slowly. In prunes, the disease may affect the entire fruit and still produce but little external evidence of its presence. Such prunes, when opened, will exhibit a brownish rotten appearance due to the work of the fungus. On account of this peculiarity, many prunes are placed in a drier with the impression that they are in good condition, but all such fail to produce a good quality of dried fruit.

It has been frequently claimed that the germ tube of this fungus is unable to penetrate uninjured epidermal tissues, and the author states that the disease rarely attacks an uninjured prune until the ripening process is well under way. This is probably due not alone to the resistant epidermis of the prune, but also to the small amount of moisture in the atmosphere during the summer months. Observations made during two seasons have shown in nearly every instance that prunes infested with the brown rot early in the season had first been attacked and the epidermis broken by the larvæ of the peach-twig borer (*Anarsia lineatella*). Investigations have been conducted to ascertain the manner in which the fungus passes the winter, from which it appears that the spores are carried over to a large extent in the mummy fruits. Among the remedies suggested for the prevention of this disease are the destruction of mummy fruits and thorough spraying of the trees with Bordeaux mixture.

Brunissure of the vine and other plants, A. F. WOODS (*Science, n. ser., 9 (1899), No. 223, pp. 508-510*).—The author briefly reviews the statements of Viala and Sauvageau describing brunissure of the vine and the California vine disease which is said to be due to *Plasmodiophora vitis* and *P. californica*. Subsequent to these investigations Debray claimed the parasite belonged to a new genus and gave it the name *Pseudocommis vitis*. The directions given for the study of this organism are to slowly clear sections or tissues in dilute eau de javelle. The protoplasm of the host cell is said to be dissolved, while the plasmodia remain for a long time unattacked. These may be stained with iodin or other stains, bringing out their structure very sharply.

The author of the present paper has studied a number of plants, among them the grape, lily, tobacco, tomato, rose, hyacinth, and spirogyra, and he states that under the microscope a slight plasmolysis of the cells may be observed, which may increase or afterwards disappear. The chloroplasts swell and become colorless, uniting with each other and usually with the rest of the protein into an amorphous, almost transparent mass. This in turn contracts into a single vacuolated plasmodium-like structure or into several such structures in each cell. They are highly refractive and remain without much change for several hours or disappear, according to the strength of the reagent. In this stage they may be coagulated with alcohol or iodin, stained, and permanently mounted. Changes of this kind are not produced by a mixture of 5 per cent sodium chlorid and 1 per cent sodium hydrate or by either acting alone.

In the author's opinion his observations indicate quite clearly that the supposed *Pseudocommis vitis* is nothing but micro chemical reaction brought about by the oxidation and the influence of alkali upon the protein contents of the cell, especially upon the chloroplasts.

Notes on some destructive fungi, C. B. PLOWRIGHT (*Gard. Chron., 3. ser., 25 (1899), pp. 392, 393, figs. 2*).—Notes are given on a willow-destroying fungus (*Cryptomyces aureus*), elm-tree parasite (*Polyporus ulmarius*), and of an alder parasite (*Ditopella fusispora*).

The willow parasite first appears on the young twigs where the shining black patches surrounded by a very distinctly marked bright yellow border contrast very strikingly with the smooth green bark. On the older twigs the yellow zones are not so distinct, and upon the still older branches they are practically obliterated. The diseased patches extend in a centrifugal manner so that the branches become denuded of their bark and the outer segment of the wood tissues dead and blackened by the fungus. The affected branches die after a time and seriously affect the appearance of the shrubs.

The elm-tree fungus is said to be a true parasite, and its method of growth results in the hollowing out of the trees. It is a perennial, and although the host plant is seriously affected it continues to live for a number of years.

The alder parasite is found upon dead alder twigs while they are still attached to the trees. The bark of the affected branches assumes a bright reddish-brown hue contrasting strikingly with the greenish hue of the living twigs. The line of demarcation between dead and live tissues is very abrupt. The fungus is also known to be a wound parasite, gaining entrance through any broken ends of the twigs. The dead twigs may remain all the year and probably more than a single season, but the perfect fungus will be encountered only during the winter months.

On the parasitism of Ximenia americana, E. HECKEL (*Compt. Rend. Acad. Sci. Paris, 128 (1899), No. 22, pp. 1352, 1353*).—The author reports experiments with 2 lots of seed of this plant, in which 1 lot was germinated in pots and the other allowed to germinate in the soil under other plants. In the first case the haustoria not being able to affix themselves to the roots of neighboring plants, seized upon the stem and seed of the plant itself, establishing a sort of autoparasitism. In the second case the haustoria were carried to the roots of neighboring plants and fastened upon them. The phenomena of parasitism, it is said, has heretofore been unknown for this family of plants.

Treatment of plant diseases in 1897, F. D. CHESTER (*Delaware Sta. Rpt. 1898, pp. 39–46, fig. 1, dgms. 2*).—In continuation of the work begun 3 years previously, experiments were conducted for the prevention of apple scab in Winesap and Strawberry apples. Bordeaux mixture was applied to the trees, 2 applications being made before the time of blooming and one or two afterwards. To the last one or two sprayings, Paris green at the rate of 4 oz. per barrel was added to the fungicide. At harvest the apples were graded, and the yields tabulated. It appears that the attacks of scab were very disastrous to Strawberry apples, the entire yield from the unsprayed trees being unmarketable, while those trees which were sprayed 4 times gave about 65 per cent of marketable fruit. In the case of Winesaps the trees receiving 4 sprayings gave practically a full crop of perfect fruit, the unsprayed trees yielding 58.4 per cent of worthless apples.

In continuation of previous experiments, plat experiments were conducted on the use of sulphur for the prevention of scab of potatoes. There was reason to believe that the land used was infected with the scab fungus, and flowers of sulphur, at the rate of 300 lbs. per acre, was spread broadcast, just before planting, and harrowed in. At harvest the crop was graded, and as a result of the experiment it was found that the use of sulphur diminished the amount of scab from 26.8 per cent on the untreated plat to 12.4 per cent on the sulphured plat.

Report of the botanist, C. E. BESSEY (*Nebraska Bd. Agr. Rpt. 1898, pp. 139–161*).—A preliminary account of the diseases of the farm crops of Nebraska is given, in which the more important diseases are popularly described and remedies suggested.

Concerning the grain rusts in Austria during 1898, L. HECK (*Ztschr. Landw. Versuchsw. Oesterr., 2 (1899), No. 4, pp. 16, pl. 1*).

The rusts of our grain fields, O. LUGGER (*Farm Students' Rev., 4 (1899), No. 9, pp. 138–140, figs. 4*).—A compiled article treating of the life history of some rusts.

Investigations of some Swiss rusts, E. JACKY (*Ber. Schweiz. Bot. Gesell., 9 (1899), pp. 49–78; abs. in Hedwigia, 38 (1899), No. 5, Repert., pp. 215, 216*).—Notes are given on *Cæoma saxifragæ*, *Uromyces aconiti*, *Puccinia agrostidis*, *Melampsora æcidioides*, *M. populina*, *M. larici-capræarum*, *M. helioscopiæ*, *Puccinia dioicæ*, and *P. ægopodii*. The different host plants are mentioned and the æcidial forms of a number described.

Phoma betæ as the cause of leaf spot and a seed disease of beets, B. FRANK (*Ztschr. Ver. Deut. Zuckerind., 48 (1899), II, pp. 711–717*).

Observations on beet diseases which appeared in the Province of Saxony during 1898, M. HOLLRUNG (*Ztschr. Ver. Deut. Zuckerind., 1899, No. 518, I, pp. 256–262*).

Sugar-beet diseases in 1898, FRANK (*Ztschr. Ver. Deut. Zuckerind., 1899, No. 518, I, pp. 251–255*).

Bacterial rots of plants, L. BUSSARD (*Rev. Vit., 1899, Nos. 282, pp. 525–527; 285, pp. 613–616*).

The bacterial diseases of the potato, FRANK (*Centbl. Bakt. u. Par., 2. Abt., 5 (1899), Nos. 3, pp. 98–102; 4, pp. 134–139, figs. 3*).—Describes the effect of *Micrococcus* spp. on potato tubers.

Two sclerotia diseases of potatoes, E. J. MacWeeney (*Trans. British Mycol. Soc., 1897–98, p. 67*).

Two new diseases of cherries, L. Pynaert (*Tijdschr. Boomteelkunde, 1899, pp. 118–120*).

The black rot, G. Cruderic (*Bul. Soc. Cent. Agr., Hort., et Acclimation, 39 (1899), No. 8, pp. 141–144*).

Observations on the development of black rot, Guillon and Gouirand (*Rev. Vit., 1899, No. 280, pp. 453–455*).

The black rot in Gardillac during 1898, G. Cazeaux-Cazalet and J. Capus (*Rev. Vit., 1899, Nos. 276, pp. 341–348; 277, pp. 377–383; 278, pp. 403–405; 279, pp. 427–431*).

Combating Oidium tuckeri and Peronospora viticola, P. Held (*Württemburg Wchnbl. Landw., 1899, No. 22, p. 341*).

The diseases of coffee, D. Delacroix (*Rev. Cult. Coloniales, 5 (1899), No. 36, pp. 134–138*).

Gray and other tea blights (*Planting Opinion, 4 (1899), No. 37, pp. 732, 733, 738, 739*).—Popular notes are given on a number of blights that are said to threaten the Ceylon tea plantations. Suggestions are offered for their prevention, the principal of which are pruning, and collecting and burning diseased leaves.

Concerning a parasitic fungus causing a wart disease of the Japanese pine, M. Shirai (*Bot. Mag. [Tokyo], 13 (1899), pp. 153–158*).—This disease is described in Japanese.

Notes on the witches' broom of Pinus sylvestris, A. W. Borthwick (*Trans. and Proc. Bot. Soc. Edinburgh, 21 (1899), pt. 3, pp. 196, 197*).—Notes the occurrence of a well-developed hexenbesen on *Pinus sylvestris*. The growth was due to some fungus, but the species was not determined.

A fungus parasite on aloe, G. Massee (*Gard. Chron., 3. ser., 26 (1889), No. 668, p. 291, fig. 1*).—A disease due to *Montagnella maxima* n. sp. is figured and described. The fungus develops in the form of black convex, circular patches, varying from 1 to 1.5 in. in diameter. It is only known from aloe leaves, and the species attacked is not positively known.

Notes on Tuberculina sbrozzii, parasitic on leaves of Vinca major, F. Cavara and P. A. Saccardo (*Nuovo Gior. Bot. Ital., 6 (1899), pp. 322–329*).—*Tuberculina sbrozzii* is described as a new species.

The diseases and parasites of the chrysanthemum, G. Chifflot and Fatzer (*Maladies et parasites du chrysanthème. Paris: Doin, 1898, pp. 38, pl. 1*).

Treatment for the prevention of chrysanthemum diseases, H. Dauthenay (*Rev. Hort., 71 (1899), No. 16, pp. 377, 378*).—Spraying with Bordeaux mixture for the prevention of attacks of plant parasites, and sulphur or tobacco for insects are recommended.

Tree-root rot, G. Massee (*Jour. Bd. Agr. [London], 6 (1899), No. 2, pp. 166–168*).—Notes are given on *Agaricus melleus* together with suggestions of preventive measures.

Treatment of chlorosis by lime, F. Gos (*Prog. Agr. et Vit. (Éd. L'Est), 20 (1899), No. 21, pp. 142, 143*).—It is claimed that frequent application of lime to and around vines which have been attacked by chlorosis will prove beneficial. The lime on the vine and leaves will also destroy powdery mildew.

The treatment of chlorosis by lime, P. Paroissien (*Prog. Agr. et Vit. (Éd. L'Est), 20 (1899), No. 33, p. 188*).—A brief note is given of the successful use of slacked lime as a remedy for chlorosis.

Influence of wet weather upon parasitic fungi, B. D. Halsted (*Bul. Torrey Bot. Club, 26 (1899), No. 7, pp. 380–389*).—This paper was read before Section G of the American Association for the Advancement of Science August 23, 1898, and an abstract of it given in the proceedings of the association (E. S. R., 10, p. 858).

Sterilization with formalin, G. Gelm (*Staz. Sper. Agr. Ital., 32 (1899), No. 3, pp. 305–309*).—Gives details of experiments with formalin as affecting the germination of a number of fungi and growth of a dozen species of bacteria.

A lacto-cupric fungicide, E. CROUZET (*Messager Agr., 4. ser., 10 (1899), No. 8, pp. 306, 307*).—A fungicide composed of 2 kg. copper sulphate, 4 liters of milk, and water sufficient to make 100 liters. This mixture is said to remain in suspension for a very long time and is very adhesive to foliage.

Winter spraying, C. P. LOUNSBURY (*Agr. Jour. Cape Good Hope, 15 (1899), No. 4, pp. 267–270*).—Notes are given on the use of lime-sulphur-salt mixture for combating peach-leaf curl and scale insects. Where only the leaf curl is to be prevented Bordeaux mixture is recommended.

ENTOMOLOGY.

Insects injurious to beans and peas, F. H. CHITTENDEN (*U. S. Dept. Agr. Yearbook 1898, pp. 233–260, figs. 16*).—The article contains a general account of the more injurious insects of these two crops.

The pea weevil (*Bruchus pisorum*) is described and figured. A brief account is given of its habits and life history. As enemies of this insect the Baltimore oriole and crow blackbird are mentioned. As artificial remedies, the author suggests holding over the seed in a closed receptacle for a time, during which the beetles will emerge and die for want of food; late planting, fumigation of the seed with bisulphid of carbon, benzin, or gasolin; and dry heat at a temperature of 145° F. or one minute emersion in boiling water.

A description is given of the appearance, habits, and life history of the common bean weevil (*B. obtectus*). There are said to be about 6 generations annually of this insect in the latitude of the District of Columbia. It differs from the last-named species in the habit of depositing a large number of eggs in a single seed, 28 having been found in a single bean. Two species of parisitic Chalcidid flies (*Eupelmus cyaniceps* and *Bruchobius laticollis*) have been bred from this insect. As remedies the author suggests the application of bisulphid of carbon treatment and heat.

The cowpea weevil (*B. chinensis*) is now found in the District of Columbia, Maryland, Virginia, and westward and north to Iowa. It is said that in a warm indoor temperature there are 6 or 7 broods annually. This insect is preyed upon by *Pediculoides ventricosus*. The same remedies as those used for the last named species would be effective in this case. Economic and biological notes are given on the following species: *Bruchus 4-maculatus*, *B. rufimanus*, *B. lentis*, *Spermophagus pectoralis*. Against the attacks of *Macrobasis unicolor*, which often feeds upon the leaves, stems, and pods of legumes as well as other plants, the author recommends the use of Paris green in a spray, alone, or with Bordeaux mixture, or dry, mixed with from 10 to 20 parts of flour or air-slaked lime. The remedies which are recommended against *Cantharis muttalli* are driving the beetles into windrows of dry straw and burning them; sweeping them into a net; and beating them into pans of water on which is a thin film of kerosene.

The bean ladybird (*Epilachna corrupta*) is preyed upon in the egg condition by *Hippodamia convergens* and the *Coccinella transversoguttata*. Paris green as a spray may be used against this insect, but the leaves are apt to be scorched by the process. Kerosene emulsion applied as an underspray is more satisfactory.

The bean-leaf beetle (*Cerotoma trifurcata*) yields to a treatment with pyrethrum or an arsenical spray.

Brief notes are also given on the following insects: *Systena tæniata*, *S. blanda*, *Diabrotica 12-punctata*, *Heliothis armigera*, *Semasia nigricana*, *Feltia subgothica*, *Mamestra trifolii*, *Spilosoma virginica*, *Leucarctia acræa*, *Eudamus proteus*, and *Halticus uhleri*.

The principal insects affecting the tobacco plant, L. O. HOWARD (*U. S. Dept. Agr. Yearbook 1898, pp. 121–150, figs. 25*).—The tobacco flea-beetle (*Epitrix parvula*) feeds upon the tomato, potato, horse nettle, and jimson weed, besides being an important enemy of tobacco. A description is given of the appearance and damage caused by this insect. The author recommends the destruction of solanaceous weeds along the edges of the field, allowing a few clumps of these weeds to remain as trap crops which may be heavily sprayed with Paris green. When these preventive measures are not sufficient, it has been demonstrated that it is perfectly safe to spray the tobacco plants directly with Paris green. The Paris green may be used in the proportion of 1 lb. to 125 gal. of water, or it may be mixed with 20 parts of flour or dust.

The tobacco horn worms (*Protoparce carolina* and *P. celeus*) have similar habits and life histories, and are both injurious to tobacco, the former species being more abundant in the South and the latter in the North. The number of generations varies from 2 to 4 or perhaps more in different parts of the country. The caterpillars are often attacked by a bacterial disease. The remedies suggested are hand picking, spraying with Paris green, either dry or in liquid form; putting a poisonous bait in the flowers of the jimson weeds, which are visited by the moths of these two species; and the use of a sweetened preparation poisoned with arsenic and set in pans in the field.

Two species of bud worms (*Heliothis rhexia* and *H. armigera*) are well-known enemies of tobacco. The former species is more abundant toward the end of August, the caterpillars entering the ground and reappearing as moths toward the end of September. The caterpillars feed upon the rolled-up leaves or buds of the plants in August, and the next generation during September and October bore into the seed pod or flower stem. The caterpillars of the last generation enter the ground, and the insects hibernate in the pupal condition. *H. armigera* feeds mostly upon other plants and only attacks tobacco late in the season. The eggs are deposited in the buds. An arsenical spray is effective against both of the bud worms, but A. L. Quaintance recommends sprinkling poisoned corn meal in the bud of tobacco.

The new tobacco bug (*Dicyphus minimus*) has been reported as injurious in a number of States. Two generations in a year were observed in some specimens which were sent to the Division of Entomology. The entire life cycle, according to Quaintance, is about 15 days. According to the same author, a concentrated solution of nicotin diluted in 60 parts of water is an effective remedy for these bugs. Brief economic notes are added on *Pœcilocystus diffusus*, *Euschistus variolarius*, and *Corimelæna extensa.*

The tobacco-leaf miner (*Gelechia solanella*) bores between the surfaces of the leaf. There are two and perhaps more generations in the year. This insect feeds upon the potato, tobacco, horse nettle, tomato, and eggplant. From the fact that the larvæ come out of the leaf and reenter in a new place, they may be destroyed by an arsenical spray. The destruction of their native food plants about June 1 will also help materially to reduce their numbers.

A number of cutworms are known to feed upon tobacco. Three species are figured and the usual remedies recommended. Brief notes are given on *Plusia brassicæ*, *Mamestra legitima*, *Thrips tabaci*, *Aleyrodes tabaci*, *Œcanthus fasciatus*, *Dactilopius citri*, *Nectarophora tabaci*, *Diabrotica 12-punctata*, and *Limax campestris.* *Thrips tabaci* is known to be injurious in Russia and *Aleyrodes tabaci* is reported as damaging tobacco in Greece. These two species, however, have not thus far been known to attack tobacco in this country.

Economic and biological notes are given on the cigarette beetle (*Lasioderma serricorne*). The whole life cycle is said to require 47 days. The remedies recommended are fumigation with bisulphid of carbon, the use of steam and of benzin. In the bisulphid treatment, 1 oz. of the liquid should be evaporated for 62½ cubic feet of space.

Other insects reported as injuring dried tobacco are *Sitodrepa panicea*, *Calandra oryza*, and *Dermestes vulpinus.* The author believes that the use of solanaceous trap crops in the spring and thorough treatment of mutilated tobacco plants which are left standing in the fall will be found to be efficient remedies.

The chinch bug—experiments with insecticides, F. M. WEBSTER (*Ohio Sta. Bul. 106, pp. 237-256, figs. 6*).—The part of this bulletin which deals with the chinch bug is an abridged account of Bulletin 15 of the Division of Entomology of this Department (E. S. R., 10, pp. 1069-1071).

Some experiments were tried with kainit for the purpose of determining its insecticide value. Kainit was placed at the roots of grapevines in the amount of from ½ lb. to 8 lbs. to each vine. The larvæ of *Fidia viticida* were found at the end of the experiment to be not at all inconvenienced by the presence of the kainit. Experiments with kainit in a field of wheat at the rate of from 320 lbs. to 2,400 lbs. per acre gave entirely negative results; the wireworms, against which the kainit was used, being unaffected by it.

Tobacco dust to the amount of from ½ lb. to 4 lbs. was placed in shallow excavations about the stems of grapes in order to test its insecticide value against the grape-root worm. The tobacco appeared to have no effect upon the larvæ of this insect. The roots of some peach trees infested by the black peach aphis were treated with a mixture of 1 lb.

of whale-oil soap in tobacco water in the proportion of 2 lbs. of tobacco to 8 gal. of water. From 1 to 2 gal. of this mixture were poured about the peach trees. The lice were not destroyed by the application.

Bisulphid of carbon was tried as a remedy against the black peach aphis with the result that the trees were killed before the insects were destroyed. In some experiments made with bisulphid of carbon in a closed box for the purpose of testing its insecticide value upon the red spider and greenhouse aphides, it was found that these insects could be destroyed by this means without injuring the hardier plants such as chrysanthemums, pelargoniums, and cinerarias, but lettuce would not endure the treatment.

The San José scale, G. H. POWELL (*Delaware Sta. Rpt. 1898, pp. 234–246*).—An account is given of the work of the entomologist with the San José scale in Delaware. Thirty infestations are reported in the State. Experiments were tried with the following insecticides: Whale-oil soap, pure kerosene, diluted kerosene, resin wash, and the lime, salt, and sulphur wash. The last two were practically valueless, and the report is made only on the other insecticides. A number of trees, including the Bartlett, Manning, Duchess, Howell, and Lawrence varieties were treated in the spring with whale-oil soap in the proportion of 2½ lbs. per gallon of water. The first application was made February 15, and other applications a few days later with whale-oil soap at the rate of 2 lbs. per gallon of water. About 90 per cent of the scales were destroyed. About 95 per cent of fruit buds treated with 2½ lbs. of soap were injured, and those trees which were treated with the 2 lbs. mixture were damaged to the extent of about 50 per cent of their fruit buds. The amount of damage was not regular, but varied from row to row and indicated that a part of the difference was due to a difference in the soaps used.

Another experiment was tried upon trees of Bartlett, Duchess, Howell, and Kieffer pears, using 2 lbs. of potash fish-oil soap to the gallon of water. The buds were just beginning to swell when the spraying was done. The trees were sprayed twice at an interval of a few days. About 95 per cent of the scales were killed, and about 95 per cent of the buds were killed on all varieties except the Kieffer. In the fall of 1897 an experiment was made with fish-oil soap on Bartlett pear trees. Fish-oil soap was used in the proportion of 2 lbs. to the gallon of water. Potash soap, as used in the preceding experiment, was also tried for comparison with the fish-oil soap. The trees came into full bloom the next spring, although 5 per cent of the fruit buds were destroyed by each soap.

In September a large plum tree, a Duchess pear tree, a small apple tree, and a young peach tree were sprayed with 150° fire-test oil with a double Vermorel nozzle. The day on which the spraying was done was clear and windy. The plum and peach foliage was injured to some extent, but that of the apple and pear was uninjured. The peach tree was killed, the plum tree was nearly destroyed, and the apple and pear trees remained uninjured.

A number of experiments were made with various grades of oil, and the author attempted to determine the relative value for insecticide purposes of distillate oil and refined oil. He found that the distillate oil was fully as effective as the refined, and it can be had from the refineries at a much lower price than the refined oil. Trees sprayed with 150° fire distillate oil had 30 per cent of the fruit and leaf spurs injured, but there were still enough spurs left for a full crop. Trees sprayed with 150° fire refined oil suffered to about the same extent. Those trees which were sprayed with an oil called a pure distillate, 44 gravity, had nearly all the fruit spurs killed.

The scales were practically all killed by the kerosene washes. The kerosene method is, therefore, in the author's experience, much more effective in the destruction of the scale than the soap methods. The cost of the soap application is fully twice that of the kerosene. The author concludes as follows: "We feel quite certain that kerosene of 150° test, either a distillate or a refined oil, may be applied in a fine mist to dormant pear or apple trees on a clear day, and that every scale reached by the oil will be killed, but we do not feel safe in recommending its use, from our experience, on peach or plum trees."

Contribution to the study of the anatomy and biology of Phlœothrips oleæ and some new solutions of bisulphid of carbon and nicotin as insecticides, G. GUERCIO (*Atti R. Accad. Econ.-Agr. Georg. Firenze, 4. ser., 22 (1899), No. 1, pp. 50-76, figs. 6*).—The author gives an historical account of previous work on this insect, with bibliographical notices of the literature. Technical descriptions are given of the egg, the different stages of the larva, the pronymph, nymph, and adult. These descriptions are illustrated with figures. The number of eggs which are deposited by a single female varies from 10 to 30. The eggs which are laid in the spring hatch into larvæ within from 8 to 10 days. The larvæ are gregarious, whether upon the ground or upon the plant. Growth of the larvæ is slow, 30 to 35 days being required to attain the stage of pronymph. Up to this stage the insect remains on the green parts of the plant. In about a week the pronymph becomes a nymph. This usually happens about the middle of June, when the insects leave the foliage and collect together upon old scars upon the trees. Some injury to flowers and fruits is done from the middle to the latter part of August. There are 4 generations of the insect a year. The insects during all 4 generations are very active. The effect of the attacks of this insect upon the olive are figured and described. The first effect upon the leaves is noticed by discoloration in the form of a more or less regular spot; the leaf later becomes distorted to a greater or less extent, depending upon the severity of the attack. Finally the leaves show various forms of a gall like formation.

Among the other insect enemies of the olive the author mentions *Œcophora oleæella*, *Hylesinus oleiperda*, *H. fraxini*, and *Lecanium oleæ*, Different observers have thought to discover a preference of the phleothrips of the olive for certain kinds of soil, especially siliceous. The author considers this belief without foundation. The natural enemies of the insect are species of Chilocorus, Exocomus, Scymnus, Chrysopa, and a sporozoon, Coccidium.

As artificial means of checking the insect the author recommends trimming the trees so that the branches will not interlace and form an easy means for the insect to cross from one tree to another; the gathering and burning of all dry boughs and leaves; cutting away the callous growths upon the large branches of olives in winter; spraying with carbolized extract of tobacco, a 2 to 2½ per cent solution in water for the larvæ and adult stages, and a 2½ to 3 per cent solution for the nymphs. The author also recommends a simple mixture of water and petroleum, water and bisulphid of carbon, and an emulsion of bisulphid of carbon and heavy oil of wood tar rendered alkaline, the whole to be mixed with water. Simple solutions of soft soap, 2½ to 3 per cent in water, were found effective against the larvæ.

Report of investigations to determine the cause of unhealthy conditions of the spruce and pine from 1880 to 1893, A. D. HOPKINS (*West Virginia Sta. Bul. 56, pp. 197–461, figs. 99*).—This report contains an account of the author's investigations upon the destructive pine-bark beetle (*Dendroctonus frontalis*) as the chief enemy of spruce and pine in West Virginia, together with notes on a trip to Europe for the purpose of collecting living specimens of the European bark-beetle destroyer, *Clerus formicarius*, for introduction into America. About 6,000 of these insects were collected and imported to the United States, about 3,000 of them arriving in good condition. They were distributed in various badly infested localities. At the time of the distribution of these predaceous beetles it was found that the destructive pine-bark beetle had suddenly become extinct in all its stages. There was, therefore, no opportunity for testing the effectiveness of the imported beetle as a destroyer of the Dendroctonus. It was hoped that the imported Clerus would maintain itself in considerable numbers by feeding on other bark beetles, but no authentic evidence is given of their having been seen since they were released.

The bulletin contains a bibliography of titles by the author on spruce and pine insects, and an appendix in which is given a list of insects taken from spruce and pine during the years 1890 to 1898. This list includes 197 species.

Proceedings of the Imperial Russian Society for the Acclimatization of Animals and Plants. Division of Apiculture, I. A. KABLUKOV, editor (*Moscow, 1899, pp. 120; abs. in Selsk. Khoz. i Lyesov., 194 (1899), July, pp. 184, 185*).—Reports of the meetings of this division and an account of experiments made with reference to increasing honey production.

A history of the Royal Station of Agricultural Entomology, A. TARGIONI-TOZZETTI (*Nuove Relaz. R. Staz. Ent. Agr., 1. ser., 1899, No. 1, pp. 1–86*).—This article gives an account of the origin and work of the station with special reference to the most injurious insects with which the station has had to deal and the remedies which have been used with best success by the station.

The Hessian fly, F. M. WEBSTER (*Ohio Sta. Bul. 107, pp. 257-288, figs. 11*).—This bulletin is a revised account of the author's work upon the Hessian fly already published in Ohio Station Bulletin, Vol. IV, No. 7 (E. S. R., 3, p. 412); U. S. Dept. Agr., Division of Entomology Bulletin 23 (E. S. R., 3, p. 55); and Ohio Station Bulletin 51 (E. S. R., 6, p. 150). The list of enemies of the Hessian fly is taken from H. Osborn, U. S. Dept. Agr., Division of Entomology Bulletin 16 (E. S. R., 10, pp. 1074, 1075).

Life habits of the Hessian fly, W. PASPELOW (*Illus. Ztschr. Ent., 3 (1898), No. 7, p. 100*).—The spring brood injured wheat to the extent of 50 per cent and rye 20 per cent. Pupation took place in May, but the pupal stage was much prolonged by a dry summer. Hot weather is favorable to the development of the Pteromalinidæ, which destroy 50 to 70 per cent of the puparia of the Hessian fly.

On two new species of Phlœothrips, M. MATSUMURA (*Annot. Zool. Japonenses, 3 (1899), No. 1, pp. 1-4, pl. 1*).—Descriptions and biological notes are given of 2 species injurious to rice.

The animal enemies of the hop, E. GROSS (*Der Hopfen. Wien: H. H. Hitschmann, 1899, pp. 37-44*).—The author devotes this section to a discussion of the insect and snail enemies of the hop and to the parasitic and predaceous insects which assist the agriculturist by checking the undue multiplication of the injurious insects.

Pests of the hop crop, H. MYRICK (*The Hop. New York, Springfield, and Chicago: Orange Judd Co., 1899, pp. 113-158, figs. 25*).—Chapter X of the author's book on "The Hop" is devoted to a consideration of the common insect, fungus, and nematode enemies of this plant and a discussion of the remedies which have been found effective. The greater part of the discussion of insect enemies is written by L. O. Howard.

Some new notions about old insects, M. V. SLINGERLAND (*Trans. Massachusetts Hort. Soc. 1898, pt. 1, pp. 63-79*).—Contains a discussion of the many new facts recently discovered in the life history of the codling moth and the peach borer and on the changes in remedies which have followed these discoveries.

Comparative values of different methods of combating the codling moth, C. P. GILLETTE (*Colorado State Bd. Hort. Rpt. 1898, pp. 76-81*).

The scale problem, C. W. WOODSWORTH (*Oregon Bd. Hort. Rpt. 1898, pp. 371-374, pl. 1*).—A discussion of different methods for the extermination of the San José scale.

The Coccidæ of Ceylon, E. E. GREEN (*London: Dulau & Co., 1899, pt. 2, pp. 105-169+XIII-XLI, pls. 30*).—This part contains a continuation of a monograph of Chionaspis and Parlatoria. A supplementary chapter is devoted to the consideration of insecticides and insecticide machinery which are especially adapted for the control and destruction of the Coccidæ. This chapter. the author remarks, is largely a compilation of published methods, most of which are derived from the writings of American economic entomologists.

The woolly aphis attacking pear trees, F. PENEVEYRE (*Chron. Agr. Canton Vaud, 12 (1899), No. 17, pp. 383-387*).—This insect is reported as depredating on pear trees.

The louse-like insect enemies of plants in Brazil, H. VON IHERING (*Rev. Mus. Paulista, 2 (1897), pp. 385-420, fig. 1*).—The author describes species belonging to the families Aleurodidæ, Psyllidæ, Aphididæ, and Coccidæ. A brief bibliography of the subject is included.

The scale lice of sugar cane in Java, L. ZEHNTNER (*Verslag. Proefstat. Suikerriet, West Java, 1898, pp. 43-46*).—Notes on a few species of Chionaspis.

Notes on Capulinia jaboticabæ, A. HEMPEL (*Rev. Mus. Paulista, 3 (1898), pp. 51-61, pl. 1*).—This species of bark louse depredates upon a tree of the family Myrtaceæ, known as *Myrciaria cauliflora*. The author gives an account of the damage caused by the insect and a description of the adult and nymphal stages and of the eggs and larvæ. As remedies the author suggests the scraping of the old and loose bark from the trees and spraying with kerosene. Hydrocyanic-acid gas method, as described by Coquillet in *Insect Life* (*6, No. 2, pp. 176-180*), is quoted at length.

Outbreak of phylloxera in the Goulburn Valley, M. BLUNNO (*Agr. Gaz. New South Wales, 10 (1899), No. 7, pp. 677–680*).—Urges the exercise of precaution so as not to introduce the phylloxera on vines from that region.

The phylloxera problem in Italy, G. CUBONI (*Il Problema Fillosserico in Italia. Rome, 1899, pp. 14*).—This paper is a lecture which was delivered as an introduction to a course in vegetable pathology in the Royal University of Rome. It gives general outlines of the extent of infestation by the phylloxera in Italy and of the present studies on the phylloxera question.

The bark beetles of the ash (Hylesinus crenatus, H. fraxini, and H. oleiperda), A. C. FORBES (*Trans. Highland and Agr. Soc. Scotland, 5. ser., 11 (1899), pp. 245–262, figs. 12*).—The author gives careful descriptions of the 3 species of this genus, with detailed notes as to the life histories of each species and as to the differences in the tunnels made by each in the bark of the trees which they infest. Excellent illustrations are given of the different sorts of tunnels made by the 3 species.

As a preventive measure against *H. crenatus*, the author recommends the cutting down and destruction of infested trees. As a remedy for *H. fraxini*, the author recommends the cutting for lumber of the large trees during February and March, and allowing them to lie on the ground until June. The logs may then be removed and will have served as a trap in which the young larvæ will be found, and if the logs are removed a long distance from the woodland the beetles will not be able to reinfest the standing timber.

The periodical cicada, K. SAJO (*Prometheus, 10 (1899), Nos. 193, pp. 388–393, figs. 5; 194, pp. 401–406, figs. 6*).—This article contains an account of the habits and life history of the 17-year cicada, and is based largely on Bulletin 14 of the Division of Entomology of this Department.

Notes on the seventeen-year cicada, B. LANDER (*Jour. New York Ent. Soc., 7 (1899), No. 2, pp. 212–214*).—Notes on the cicada huts.

The migratory, or Asiatic, locusts; natural and artificial remedies, K. N. ROSENKOV (*St. Petersburg: Min. Agr. and Imperial Domains, Dept. Agr., pp. IV+37; abs. in Selsk. Khoz. i Lyesov., 193 (1899), May, pp. 469, 470*).—The author ascribes the migration of these locusts to the presence of their natural enemies, especially the Sarcophaginæ and the Acarina. These parasites attack the locusts after the latter have passed the second stage of larval growth. The author also recommends spraying with Paris green.

Visitation of spotted locusts, E. E. GREEN (*Roy. Bot. Gard. Ceylon Circ., ser. 1, 1898, No. 9, pp. 77–81*).—*Phymateus punctatus* is described together with an account of its injuries to areca and cocoanut palms and a discussion of its natural enemies and of the remedies to be applied against it.

The cochineal insect of Chili (Margarodes vitium), T. ALVAREZ (*Riv. Agron. Cien Apl., Paraguay, 1 (1898), No. 6–7, pp. 289–294*).—Contains notes on the habits and life history of the insect and a brief discussion of the remedies to be adopted in fighting it.

Ladybirds vs. bugs, C. FULLER (*Agr. Jour. Cape Good Hope, 15 (1899), No. 2, pp. 100–108, figs. 13*).—A popular article on the effectiveness of *Vedalia cardinalis* and *Rodolia iceryæ* in destroying *Icerya purchasi.*

The locust-leaf miner, E. D. SANDERSON (*Amer. Gard., 20 (1899), No. 249, p. 672*).—Brief notes on *Odontota dorsalis.*

Cetonia stictica in hotbeds, G. STAES (*Tijdschr. Plantenziekten, 4 (1898), No. 2, pp. 26–31*).—Reported as injuring narcissus. Its systematic position is discussed, and benzin was found to be a rather successful remedy.

Rose pests and how to exterminate them, E. M. WOOD (*Amer. Florist, 15 (1899), No. 590, pp. 222, 223*).—A popular account of the rose chafer, June beetle, green fly, rose-leaf hopper, thrips, and red spider, with suggestions of proper remedies.

Insects and fungi attacking ornamental trees and shrubs, S. T. MAYNARD (*Landscape Gardening. New York: J. Wiley & Sons, 1899, pp. 261–288, figs. 13*).—Popular notes on scales, leaf-eating beetles, and caterpillars, with directions for the use of insecticides and fungicides.

Paris green and certain other compounds vs. insect enemies of fruit gardens, S. A. Mokrzhetzky (*Simferopol, 1899, 3. ed., pp. 15; abs. in Selsk. Khoz. i Lyesov., 194 (1899), July, p. 180*).—An outline of methods for making insecticides adhere to the leaves and for combating field insects such as cicadas and locusts.

The preparation of sprays; spray calander (*Oregon Bd. Hort. Rpt. 1898, pp. 183–203, figs. 6*).—Formulas for making insecticides and fungicides with reference to special insect and fungus diseases.

The hot-water cure, G. B. Mallett (*Gard. Chron., 3. ser., 26 (1899), No. 661, pp. 166, 167*).—The different temperatures to which water should be heated in order to make an effective insecticide or fungicide are given for a number of fruits, vegetables, and greenhouse plants.

FOODS—ANIMAL PRODUCTION.

The use of milk in the manufacture of bread and confectionery, W. Smith (*Jour. British Dairy Farmers' Assoc., 14 (1899), pt. 2, pp. 93–97*).—The food value of skim milk is discussed, as well as methods for extending its use. According to the author, skim milk improves the appearance and increases the food value of bread and the amount which may be made from a given quantity of flour. Its use will more than repay the extra expenditure and care required. It is stated that 280 lbs. of flour will take up 175 lbs. of water to make a good dough for loaf bread. When baked this will yield 96 four-pound loaves, there being a loss of 71 lbs. in baking. The same amount of flour will take up 210 lbs. of skim milk and the dough will yield 110 four-pound loaves, or 14 more than is obtained when water is used. In this case there is a loss of 50 lbs. during baking. The water bread is valued at 10 cts. per four-pound loaf, and milk bread at 11 cts. Deducting the cost of the skim milk, which is estimated as $1.64, the milk bread gives 86 cts. greater profit than the water bread. Analyses of water bread and bread made with skim milk (containing 0.03 per cent fat and 9 per cent solids) are reported. Two of these follow:

Composition of bread made with water and with skim milk.

	Water.	Protein.	Fat.	Nitrogen free extract.	Crude fiber.	Ash.
	Per cent.	*Per cent*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Bread made with water	39.36	7.31	0.12	52.59	0.33	*a*0.29
Bread made with skim milk	38.64	9.19	.51	51.07	.31	*a*.28

a Including 0.15 phosphates.

The superior food value of skim milk bread is discussed and the use of skim milk for bakers' goods other than bread is treated of at some length.

Bread made from wheat by the so-called "antispire" system of Desgoffe and Avedyk, L. Pagliani and C. Mazza (*Riv. Ig. e San. Pubb., 9 (1898), No. 4, pp. 118–140, pl. 1*).—The process of making whole-wheat bread by the "antispire" system of Desgoffe and Avedyk is described. By this method the grain is rubbed into a fine powder and does not become heated. Experiments with healthy young men are reported, in which this bread was compared with army bread (black bread) and with ordinary white bread. In the following table the coefficients of digestibility obtained and the daily income and outgo of nitrogen are shown:

Experiments with bread of different sorts.

Food per day.	Time.	Coefficients of digestibility.					Nitrogen.			
		Dry matter.	Nitrogen.	Fat.	Carbohydrates.	Ash.	In food.	In urine.	In feces.	Gain.
MAN, C. P.										
	Days.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Grams.*	*Grams.*	*Grams.*	*Grams.*
200 gm. milk, 200 gm. meat, 500 gm. army bread	5	87.3	81.3	79.1	89.8	71.5	13.4	9.2	2.5	1.7
200 gm. milk, 200 gm. meat, 520 gm. "antispire" bread (made in Berlin)	5	83.8	70.3	80.6	85.6	67.3	14.3	9.5	2.8	2.0
200 gm. milk, 200 gm. meat, 565 gm. white bread	5	92.5	80.6	87.4	96.6	75.1	13.6	9.7	2.6	1.3
MAN, F. G.										
200 gm. meat, 917 gm. army bread	5	93.6	85.8	44.7	96.3	66.6	16.5	12.8	2.3	1.4
200 gm meal, 799.2 gm "antispire" bread (made in Berlin)	5	87.4	80.4	32.9	92.9	74.5	16.1	10.1	3.2	2.8
MAN.										
350 gm. milk, 150 gm. cheese, 590 gm. "antispire" bread (made in Rome)	5	88.6	73.8	82.8	81.2	73.4	14.2	9.1	3.7	1.4
350 gm. milk, 150 gm. cheese, 61.7 gm. army bread	5	92.3	80.8	93.1	92.6	75.3	13.5	10.0	2.6	.9

The principal conclusions are: The "antispire" whole-wheat bread contains a little larger percentage of albuminoids than other breads commonly in use. This bread has a nutritive value somewhat greater than army bread and somewhat less than common white bread. Since this bread may also be prepared more cheaply, its use is more economical than bread prepared from flour ground in the ordinary way.

Further investigations on the effect of fermentation on the value of hay, HOLDEFLEISS (*Mitt. Landw. Inst. Breslau, 1899, No. 1, pp. 59–74*).—In continuation of previous work,[1] the author reports experiments on the effect of fermentation which takes place in the curing of hay. From all his investigations the following conclusions are drawn: The curing of hay is not simply a drying process. In addition to drying, the hay undergoes fermentation which has a marked effect upon it. To obtain good hay it must be treated in such a way as to secure proper fermentation. The best hay is obtained if the green crop is raked into heaps or placed on drying racks after it has wilted slightly. The heaps should be from ½ to a meter high at first. After the grass or other material is more wilted, they may be 2 meters high. Drying on racks is especially desirable with leguminous crops.

---

[1] Deut. Landw. Presse, 24 (1897), p. 433.

In addition to the production of aromatic bodies, fermentation improves the hay by diminishing the quantity of crude fiber and by increasing the relative amount of other nutrients, especially nitrogen-free extract. The greater the fermentation the more the crude fiber is diminished, and this is especially marked when hay is dried on racks. Hay which has undergone proper fermentation has a better flavor and agrees with animals better and is apparently more digestible than hay which has dried quickly in the sun without fermentation. Fermentation apparently diminishes the amount of pentosans in hay, especially that made from grass. It also seems that the amount of true protein is increased.

Feeding experiments (*Agr. Students' Gaz., 9 (1899), No. 4, pp. 116, 117*).—A brief account is given of a feeding experiment with steers at the farm of the Royal Agricultural College of Cirencester. Two Aberdeen-Angus steers fed during the winter a daily ration of 4 lbs. decorticated cotton-seed cake, 6 lbs. maize meal, 18 lbs. hay and chaff, and 15 lbs. roots, gained 14 lbs. per head per week. The cost of a pound of gain was 10.5 cts. Two similar steers fed a daily ration of 7 lbs. linseed cake and 3 lbs. oatmeal, with the same amount of hay, chaff, and roots as the others gained 12 lbs. per head per week, the cost of a pound of gain being 15 cts. The dressed carcass in the first lot constituted 60.6 per cent of the live weight and in the second 59.3 per cent. The flesh of the first lot was regarded as superior, showing more lean in proportion to fat. The composition of the concentrated feeds used is reported.

Poultry experiments, J. DRYDEN (*Utah Sta. Bul. 60, pp. 119–137, figs. 10*).—The experiments, which are a continuation of previous work (E. S. R., 10, p. 77), have to do with the relative value of year-old hens and pullets, early and late hatched pullets, and the effect of exercise on egg production, as well as a comparison of different breeds. Ten lots were used in the tests. Lots 1 to 5 each contained 5 Rose-comb Brown Leghorns, lots 1 and 2 being early-hatched pullets; lots 3 and 4, early-hatched year-old hens, and lot 5 late-hatched pullets. Lot 6 contained 3 Black Leghorn pullets; lot 7, 5 late-hatched Barred Plymouth Rock pullets; lot 8, 4 year-old Light Brahma hens; lot 9, 5 late Brahma pullets, and lot 10 Barred Plymouth Rock pullets. Three of the lots (Nos. 3, 4, and 8) were used in the test of the previous year. All the chickens were given in the morning a warm mash of bran, ground oats, and ground corn (2:1:1), seasoned with salt and a little cayenne pepper. During the forenoon a little whole grain (oats and wheat on alternating days) was fed, and late in the afternoon all the wheat they would eat up clean. Three times a week all the lots were given cut green bone or meat scraps. A suitable amount of green food was also supplied. The lots were kept in pens, as in the previous test. Lots 2 and

3 were fed from boxes and had no exercise. All the other lots had exercise. This consisted in scratching for the grain ration, which was scattered in straw litter. With the exception of 3 lots the test covered 1 year, beginning November 9, 1897. With lot 6 it began about 1 month later; with lot 7, about 4 months later, and with lot 10 about 2 months later. Records were kept of the temperature of the poultry house. The following table summarizes the principal results of the test:

Results of feeding test with chickens.

Lot.		Cost of food per fowl.	Average number of eggs laid per fowl.	Value of eggs.	Cost of food per dozen eggs.	Profit on food.
	WITHOUT EXERCISE.	*Cents.*			*Cents.*	*Per cent.*
2	Pullets	64.4	157	$1.81	4.9	185
3	Year-old hens	62.1	150.8	1.68	4.9	170
	WITH EXERCISE.					
1	Pullets	67	160.2	1.91	5	182
4	Year-old hens	66.5	114.2	1.11	7	67
5	Late-hatched pullets	60.5	164.6	1.78	4.4	194
6	Black Leghorn pullets	74.6	130	1.33	6.9	77
7	Late-hatched barred Plymouth Rock pullets	[a]56.7	105	1.11	6.5	97
8	Year-old light Brahmas	90.2	97	.96	11.1	8
9	Light Brahma pullets	82.9	129	1.33	7.7	37
10	Barred Plymouth Rock pullets	[b]72.2	127	1.28	6.9	77

[a] For 8 months.

[b] For 10 months.

The results of this trial and those of the previous year are discussed at length. Some of the principal conclusions follow:

"The best egg record during the second year was made by a pen of Brown Leghorn pullets, hatched June 10. . . .

"As to the effect of exercise [on the amount of food required to produce a dozen eggs], contradictory results were secured. . . . Exercise had little apparent effect on the weight of the fowl, that little being a slight increase in weight. The eggs from the 2 lots without exercise averaged 4 per cent heavier than those from the 2 exercised lots. This confirms results of the previous year. The eggs from lots 3 and 4 weighed 3½ per cent more during their second year than during their first. The exercised lots consumed a trifle more food than those without exercise.

"The eggs from the 2 lots of Light Brahmas weighed an average of 1.64 lbs. per dozen; those from the 5 lots of Brown Leghorns averaged 1.46 lbs. per dozen, or about 12 per cent in favor of the former."

Maize as a popular article of diet in Servia, A. Zega and R. Majstorović (*Chem. Ztg., 23 (1899), No. 51, pp. 544, 545*).—The authors describe the ways of preparing and serving ground and ripe maize in Servia. The unripe ears are roasted or boiled, a variety of maize is popped, and several sorts of bread and similar articles and a fermented beverage are made from maize meal. The composition of yellow and white maize meals is reported as well as that of the boiled maize, popped corn, and a number of sorts of maize bread, etc.

Sugar as food, F. Strohmer (*Chem. Ztg., 23 (1899), No. 44, p. 467*).—An abstract of an address before the meeting of the "Central-Vereins für Rubenzucker-Industrie" of Austria-Hungary at Bozen in May, 1899.

Chemical analysis of bread made by the "antispire" system of Desgoffe and Avedyk, P. Griacosa (*Riv. Ig. e San. Pubb., Roma, 9 (1898), No. 4, pp. 140–147*).

Macaroni wheats (*Agr. Gaz. New South Wales, 10 (1899), No. 9, pp. 980, 981*).—Notes on macaroni making and on growing macaroni wheats in Australia.

Edible flowers (*Jour. Hyg., 24 (1899), No. 1183, pp. 168, 169*).—A popular article taken from *Bul. Soc. Hort., Orleans et Loiret.*

Cold storage for eggs (*Agr. Gaz. New South Wales, 10 (1899), No. 9, pp. 889, 890*).—The value of cold storage for preserving eggs is pointed out. Notes are given on the application of this method in New South Wales.

Practical introduction to the chemistry of nutrition, H. THOMS (*Einführung in die praktische Nahrungsmittelchemie. Leipzig: S. Hirzel, 1899, pp. VIII + 415, figs. 115*).—This contains a botanical and microscopical section by E. Gigl.

Simple methods of examining food materials, beverages, air, water, illuminating materials, etc., P. O. SMOLENSKI (*Prostyeĭshie Sposobuĭ Īzslyedovaniya Ī Otzyenki Dobrokachestvennosti. St. Petersburg, 1899, 3. ed., pp. 526*).—This volume includes chapters on nutrition, meat and meat products, fish and fish products, milk, cream, butter, cheese, fats and oils, eggs, honey, flour, meal, bread and confectionery, leguminous seeds, vegetables, beverages, including tea, coffee, wine, beer, etc.; condiments, spices, preservatives, coloring matters injurious to health, kitchen utensils, air, water, water supplies, soil, dwellings, illumination and illuminants, and clothing. Many references are given to works in Russian and other languages.

The adulteration of flours with rye, buckwheat, rice, barley, maize, beans, and potato starch, BALLAND (*Jour. Pharm. et Chim., 6. ser., 8 (1898), Nos. 5, pp. 239–243; 6, pp. 286–290*).

The examination of flour, J. HOCKAUF (*Oesterr. Chem. Ztg., 2 (1899), No. 15, pp. 409–412*).—Some of the recent work on the examination of flour for the detection of adulterants is reviewed.

Microscopic examination of wheat flour, E. COLLIN (*Jour. Pharm. et Chim., 6. ser., 8 (1898), Nos. 3, pp. 97–105; 4, pp 150–156, fig. 1; 5, pp. 200–211, figs. 2*).—Histology of the wheat kernel and comparison of wheat flour with like materials used as adulterants.

Some results of dietary studies in the United States, A. P. BRYANT (*U. S. Dept. Agr. Yearbook 1898, pp. 439–452*).—The principal results of the dietary studies made among people of different incomes and occupations in the United States are cited, and ways are pointed out in which the information obtained may be used.

Inspections of milk tests and feeding stuffs, J. L. HILLS (*Vermont Sta. Bul. 68, pp. 33–38*).—Some of the reasons for legislation to protect dairymen and purchasers of feeding stuffs are given, as well as the text of the Vermont laws on these subjects. . The essentials of the laws are discussed.

Utilization of residues from beet-sugar manufacture in cattle feed, G. L. SPENCER (*U. S. Dept. Agr. Yearbook 1898, pp. 213–220*).—The author discusses the feeding value of beet tops, pulp, and molasses. In his opinion the tops, which contain a comparatively large percentage of various salts, should be left on the soil for their fertilizing value unless the manure of the animals fed is returned to the land. Foreign experiments on the feeding value of beet pulp for farm animals are cited from a previous publication of the Department (E. S. R., 9, p. 344), and the successful feeding of the pulp and molasses in the United States is briefly treated of.

Food value of guinea grass (*Queensland Agr. Jour., 5 (1899), No. 3, pp. 302–304*).—The work of the Botanical Garden of Trinidad (E. S. R., 10, p. 1089) on guinea grass (*Pancium maximum*) is cited and discussed.

Treatise on the oil-bearing seeds and vegetable oils, GABAIN BROS. (*Traité sur la question des graines oleagineuses et des huiles végétales. Havre, 1899, pp. 32*).

The influence of fermentation on the value of hay (*Deut. Landw. Presse, 26 (1899), No. 56, pp. 643, 644*).—A brief account of Holdefleiss' experiments (see p. 479).

Problems and progress of animal physiology in relation to agriculture, N. ZUNTZ (*Leistungen und Aufgaben der Tierphysiologie im Dienste der Landwirtschaft. Berlin: P. Parey, 1899, pp. 16*).

Animal heat. Chemical principles of the production of heat by living animals, BERTHELOT (*Chaleur animale. Principes chimiques de la production de la chaleur chez les etres vivants. Paris: Gauthier-Villars, 1899, vol. 1, pp. XVI + 171; vol. 2, pp. 151*).—Volume 1 contains the text and volume 2 the tables.

The formation of fat from protein in a cat, M. CREMER (*Ztschr. Biol., 38 (1899), No. 2, pp. 309–314*).—A controversial article in which a metabolism experiment with a cat is reported which is believed to establish the formation of fat from protein.

Metabolism experiments with proteid bodies containing phosphorus and free from phosphorus, H. ZADIK (*Arch. Physiol. [Pflüger], 77 (1899), No. 1–2, pp. 1–21*).—Experiments with a dog are reported in which the balance of income and outgo of nitrogen was determined.

The effect of sugar, J. VON KÓSSA (*Arch. Physiol. [Pflüger], 75 (1899), No. 6–7, pp. 310–331*).—A number of experiments with birds and mammals are reported in which sugar solutions (usually saccharose) were injected subcutaneously. The author concludes that large doses thus injected or small doses when continued for a long time produce serious pathological changes.

The effect of sodium chlorid on the cleavage of protein, W. STRAUB (*Ztschr. Biol., 37 (1899), No. 4, pp. 527–549, dgms. 5*).—The balance of income and outgo of nitrogen was determined in a number of experiments with a dog. The conclusion was reached that sodium chlorid diminished the cleavage of protein, although the effect was slight.

The excretion of phosphoric acid after castration, N. SCHULZ and O. FALK (*Ztschr. Physiol. Chem., 27 (1899), No. 3, pp. 250–254*).—In view of experiments with female dogs the authors conclude that Curàtulo and Tarulli's[1] opinion that the increased excretion of phosphoric acid in the urine after castration is due to retention of phosphorus in the body is not substantiated. Their own experiments do not enable them to explain the cause of this increase.

The value of accurate determinations of the sulphur in urine in judging of changes which take place in metabolism, E. HARNACK and F. K. KLEINE (*Ztschr. Biol., 37 (1899), No. 4, pp. 417–442*).—A number of experiments are reported. The general conclusion was drawn that determinining the sulphur in urine is not of great value in judging of disease, since this factor is greatly influenced by the food.

Rational stock feeding, F. E. EMERY and J. M. JOHNSON (*North Carolina Sta. Bul. 163, pp. 261–286*).—This is a general discussion of the subject, the topics treated of being definition of terms, composition and digestibility of feeding stuffs, feeding standards, and the method of calculating rations. The bulletin includes a table showing the coefficients of digestibility of a large number of feeding stuffs and mixed rations. In every case the source of the figures given is indicated.

Handbook of the rational culture of fields and meadows and the utilization of crops based on the modern theories of feeding, R. BRAUNGART (*Handbuch der rationellen Wiesen- und weiden-Kultur und Futterverwendung, entwickelt und ausgestaltet auf den Grundlagen der modernen Fütterungslehre. München: T. Ackerman, 1899, pp. VII + 664*).

The maintenance ration of cattle, H. P. ARMSBY (*Pennsylvania Sta. Rpt. 1897–98, pp. 65–71*).—A brief summary of some of the principal results and deductions reported in Bulletin 42 of the station (E. S. R., 10, p. 1079).

Keeping goats for profit, A. BARNES (*U. S. Dept. Agr. Yearbook 1898, pp. 421–438, pls. 2*).—Statistics of the number of goatskins used annually in the United States and of the number of goats raised here and abroad are given, as well as of the uncultivated land suitable for goat raising available in this country. Since so few of the goatskins needed are produced here, the author believes goat keeping may be made a profitable industry, since the milk, hair, flesh, etc., may also be made to yield considerable returns.

Feeding and slaughter experiments with pigs fed animal meal and the residue from the manufacture of tropon, O. HAGEMANN and E. RAMM (*Deut. Landw. Presse, 26 (1899), Nos. 70, pp. 790, 791, figs. 12; 71, pp. 805, 806, fig. 1*).—Feeding and slaughter experiments are reported with 3 lots of 2 pigs each: One lot was fed animal meal and one the residue from the manufacture of tropon, while the third lot served as a control.

---

[1] La secrezione interna delle ovaie. Rome: Fratelli Centenari, 1896.

Stations for raising poultry, KNAUP (*Ztschr. Landw. Ver. Hessen, 1899, No. 34, pp. 428–431*).—A plan for cooperation in raising poultry is described and instances cited to show that the plan may be successfully carried out.

Russian poultry and egg industry (*Jour. Bd. Agr.* [*London*], 6 (*1899*), *No. 1, pp. 28–33*).—A somewhat extended account is given of egg production and marketing in Russia.

Five hundred years of pisciculture at Wittingau, J. SUSTA (*Fünf Jahrhunderte der Teichwirthschaft zu Wittingau. Stettin: Herrcke & Lebeling, 1899, pp. XI+232*).

DAIRY FARMING—DAIRYING.

Contributions on the rational nutrition of cows, O. HAGEMANN (*Landw. Jahrb., 28* (*1899*), *No. 3–4, pp. 485–534*).—The principal object of this investigation was to determine whether rations rich in fat produce milk with high fat content, as claimed by Soxhlet (E. S. R., 8, p. 1016). Two cows were used, and feeding and metabolism experiments were made with different rations in 6 periods. The basal ration consisted of hay, straw, dried beet diffusion residue, and salt. To this was added in the first period malt sprouts, in the second period peanut-cake meal and a mixture of 50 parts by weight of cocoa shells and 40 parts of molasses, in the third period linseed meal, and in the fourth period "maize-cake meal." In the fifth and sixth periods the rations were the same as in the first, except that 500 gm. of sesame oil, emulsified in the drinking water, was added in the fifth period, and sesame oil in a weak alkaline emulsion in the sixth period. These rations furnished quite widely varying amounts of fat. The experiment began December 13, 1897, and continued until May 27, 1898. The metabolism experiment covered 10 days in each period except the last, which was only 7 days, as the cows would not drink the alkaline emulsion longer. The individual record for the production of milk and fat and for the metabolism experiment is given for each period.

All the calculations of the results of the experiment are based upon the amounts of nutrients digested, as shown by the digestion experiments In considering the results account is taken of the natural shrinkage with advancing lactation. On the supposition that except for the difference in rations the shrinkage would have been regular from month to month, a table is presented which shows the actual yields of milk and fat, and the calculated yields allowing for a regular shrinkage between the first and fifth periods, during which practically the same rations were fed. The difference between the actual yields and the calculated yields in any period is assumed to be due to the ration. The actual milk yield in the intervening periods is shown to be higher than the calculated yield, allowing for natural shrinkage. Although a larger amount of total digestible nutrients was eaten in these periods it is thought that this alone could not have accounted for the increase, for in period 3, when the largest increase in yield was apparent, the smallest amount of nutrients was digested. The largest amount of digestible protein was consumed in this third period, however, which is thought to bear out the theory that milch cows require rations rich in protein.

In regard to the fat, the results furnish no indication that the fat of the food affects the production of fat in the milk. The largest amount of fat was digested in the fourth period, but the milk in that period was poorest in fat. The ration in the third period contained considerably less fat but the milk was richer in fat and contained a larger total amount. The largest total yield of fat and the largest percentage of fat in the milk occurred in the second period, when the ration contained approximately the right amount of fat for a cow (218 gm. for a cow weighing 560 kg.), the smallest amount contained in any of the rations rich in fat.

The author concludes that neither the percentage nor the absolute amount of milk fat is dependent upon the fat digested from the food. He believes that some feeding stuffs contain certain materials, the nature of which is at present unknown, which stimulate the lacteal glands to greater general activity in some cases, and in other cases so modify the cell activity of the glands that a milk richer in fat is produced. This is held to explain why the fat content increased so materially under the mixture of cocoa shells and molasses, and why in the fourth period on maize-cake meal the milk yield was maintained in spite of the natural shrinkage, although the fat content of the milk diminished. The author cites numerous experiments in support of this hypothesis, among others some conducted by Ramm and himself (E. S. R., 9, pp. 788, 879) on 10 concentrated feeding stuffs of widely different fat content. In these experiments the 2 feeding stuffs poorest and richest in fat both gave milk with the same fat content, while the poppy cake, very rich in fat, gave milk with the lowest fat content, and the mixture of molasses and palm-nut cake, which was very poor in fat, gave much the highest fat content.

During the time the emulsified sesame oil was fed the milk yield decreased and the fat content increased slightly, but this is believed to have been due to the advanced stage of lactation rather than to the effect of the oil. At that time the cows were giving less than 3 qts. of milk per day. They refused to take the emulsion after the seventh day. The substance giving the characteristic sesame-oil reaction was not transmitted from the food to the milk.

Herd testing, C. L. PENNY (*Delaware Sta. Rpt. 1898, pp. 159–197, dgms. 2*).—The author discusses the utility of herd testing; fluctuations in quantity and quality of milk from morning to evening, from one day to the next, from the beginning of lactation to the end, and from year to year; basis of herd selection; balancing a herd; determining the efficiency of dairy cows, and the ratio of butter fat to total solids. The discussion is based on results of tests of a large private herd, covering a number of years, a large part of the data for which are given in tabular form.

The results bearing on fluctuations in milk from morning to evening are summarized as follows:

> "In comparison between morning and evening of the same day, out of 109 distinct observations, 46 showed more milk in the morning, 57 more in the evening, and 6 equal quantities. Out of 104 distinct observations, 72 showed a higher percentage of fat in the morning, 27 in the evening, and 5 an equality in percentage."

A table gives the detailed data for a test of 5 cows for 3 periods of one week each, with averages for each cow for the different periods. The differences in yield of milk from one morning to the next and from one evening to the next are reported separately as the daily fluctuations. The average of each series of daily fluctuations is expressed in actual weight and as a percentage of the average yield for the period.

> "It appears from the table that the least mean fluctuation in weight of milk from one morning to the next, or from one evening to the next, is 0.26 lb., equivalent to 2¼ per cent, and that the greatest mean fluctuation within any one period is 1.58 lbs., equivalent to nearly 12 per cent.[1] . . . The average of the 5 cows for the 3 periods is a mean daily fluctuation in percentage of fat of 0.29 per cent, while the average of the extreme fluctuations within each several period is 0.56 per cent."

Computed for semi-weekly periods, the average fluctuation in butter fat was 0.08 per cent, in contrast to the daily fluctuations of 0.29 per cent. "This shows how much nearer the truth is a three-day sample than a sample from a single milking."

With regard to compensation in yield, the results of several tests are noted as showing that within short intervals of time "it is not the general rule that an increase of quantity means a decrease in solids, but rather the independence of the two, with a slight inclination in the opposite direction, *i. e.*, with a slight inclination to show the heavier yield of milk to be richer in quality than the poorer."

Eleven cows were each tested 3 times at equal intervals during the period of lactation. The average results showed a uniform decline in yield of butter fat. The individual cows, however, showed great irregularities, indicating that tests at repeated intervals during the period are necessary to determine the productiveness in the case of individual cows. Annual fluctuations in yield are not considered sufficiently great from a practical standpoint to warrant the testing of a cow beyond the first period of lactation, or, if the indications are unfavorable, beyond the second period.

Under basis of herd selection, the author discusses different bases depending upon the use to be made of the milk. The municipal ordinance of Philadelphia prescribing for milk a minimum content of 12 per cent solids and 8.5 per cent solids-not-fat is not considered a good basis as it makes no requirement for fat. Balancing a herd consists in combining cows of high yield in solids so that the mixed milk will, with maximum weight, clear the legal standard as to quality. The efficiency of a cow may be determined by computing the arithmetical mean of the tests made at equal intervals during one period of lactation. In this way the relative order of merit of 46 cows as regards production of milk, total solids, and butter fat was determined. Of the whole number, 19 gave over half of the weight of milk, 20 over half of the solids, and 21 over half of the butter fat. The ratio of butter fat to total solids in one herd was found to vary from 0.238 to 0.427, with an average of 0.312.

---

[1] A communication from the author states that the greatest mean fluctuation should have been given as 2.53 lbs., equivalent to 21.3 per cent.

Investigations on the varying composition of butter, J. J. L. VAN RIJN (*Chem. Ztg., 23* (*1899*), *No. 43, pp. 453, 454*).—The investigation relates to the volatile fatty acids of butter. During the months of September, October, November, and December weekly samples of butter were taken from 24 different places in various parts of Holland. In this way about 700 samples of butter were examined. In these samples the volatile fatty acids were found to range between 17 and 32, being for the larger number of samples between 23 and 26, although the figures 20, 21, and 22 were quite frequent. Half of the samples showed less than 25 volatile fatty acids and thus were below what is usually considered the normal for butter fat.

About half the butter examined was made from mixed milk of 500 to 1,000 cows, so that no individual influence could have been exercised. Nearly all of the cows had calved between the previous February and April. It was found that there was a decrease in the volatile fatty acids with advancing lactation up to some time in October, when there was an increase; and there was a noticeable connection between the increase in volatile fatty acids and the time the cows were taken off of fall pasturage and fed in the barn. The author concludes that stall feeding has a marked influence on the composition of butter, and that this affords a means of preventing the volatile fatty acids of the butter from falling so low in the autumn as to be suspected of being adulterated with margarin, under present laws.

Keeping milk in summer, H. M. COTTRELL, F. C. BURTIS, and D. H. OTIS (*Kansas Sta. Bul. 88, pp. 7, figs. 7*).—An account is given of a method employed at the station during the summer for keeping milk in good condition for 40 to 52 hours without the use of ice and at a very small cost. The building used for this purpose was made of old fence boards and covered with building paper. The total cost was about $5. The milk was cooled immediately after milking to about 60° F. by passing over a milk cooler. The cans containing the milk were placed in half barrels and surrounded with well water, which was changed morning and night. Care was taken to avoid contaminations in milking and handling. The results are considered as showing that "any farmer in the State can deliver milk in good condition to the creamery in the hottest weather, and deliver Sunday's milk as well as that of other days."

Bacteria in cheese, J. WEINZIRL (*Bul. Sci. Labs. Denison Univ., 11* (*1899*), *Art. 7, pp. 149–163*).—The author reviews the work of others on this subject and reports some investigations made by himself in collaboration with H. L. Russell of the Wisconsin Station. The examination of 6 experimental cheeses showed "the overwhelming preponderance of the class of germs we have designated as the lactic-acid bacteria, while the casein digesters are relatively few in number and soon disappear from the cheese entirely."

To study the distribution of these classes of bacteria in cheese, 36 samples of cheese procured from 9 of the principal cheese-producing States were examined. The lactic acid producing germs were found in all of the samples, being the most numerous class in three-fourths of the samples. Gas-producing germs were present in all samples but one and were the most numerous class in approximately one-fourth of the cheeses.

> "The presence in relatively small numbers or the entire absence of the digesting and neutral classes confirms our conclusion that these play no important function in the cheese and are present in it only because they were present in the milk, perhaps by accident or carelessness in handling the product, but never really flourish in the cheese medium. . . . There can scarcely be any question that [the lactic-acid bacteria] are directly beneficial, although playing no important rôle in changing the casein into soluble products. . . . They probably furnish much of the flavor peculiar to our best cheese."

Investigations on the ripening of Edam cheese, F. W. J. BOEKHOUT and J. J. O. DE VRIES (*Landbouw. Tijdschr., 7 (1899), pp. 65–81; Centbl. Bakt. u. Par., 2. Abt., 5 (1899), No. 9, pp. 304–307*).—Culture tests were made to discover what sort of bacteria were found in the cheese, using whey gelatin as culture medium. Both aerobic and anaerobic cultures were made, although it is assumed that cheese contains no free oxygen. Edam cheese made with milk colored blue by means of indigo sulphanid of soda was colorless at the end of 2 days, the indigo being reduced to white indigo. Sections exposed to the air turned blue again on account of the absorption of oxygen by the white indigo, indicating that the cheese was free from oxygen. Like Freudenreich, only lactic-acid micro-organisms were found in the cheese. Subsequent cultures with milk gelatin as medium led to the same results, indicating lactic-acid organisms to be the cause of the ripening process. Accordingly, cheese was made from milk pasteurized at 70° C. and inoculated with lactic acid bacteria isolated from Edam cheese. This cheese did not ripen. The experiment was repeated with other lactic-acid bacteria likewise isolated from Edam cheese, but with no better success. Inoculation of pasteurized milk (70° C.) with a mixture of lactic bacteria was likewise unsuccessful.

On the theory that the ripening might be due to bacteria which are not susceptible to culture, milk pasteurized at 70° C. was inoculated with a piece of Edam cheese 14 days old. This, however, did not ripen. The theory of Weigmann that the ripening process is the result of different micro-organisms working consecutively, and soon dying, was tested with milk pasteurized at 70° C. to which 1 liter of market milk was added, with negative result.

The preceding tests were repeated with milk pasteurized at 55° C., but while there was a more decided ripening, it was not normal. Milk was then used which was drawn from 4 cows under as nearly aseptic conditions as possible. Separate portions were inoculated with young cheese (14 days old), with a lactic-acid ferment isolated from Edam cheese, and with ordinary commercial milk. The results were now quite different. Cheese from milk inoculated with young cheese and with commercial milk ripened well, but that from the use of lactic organisms did not ripen. The three control portions not inoculated gave no ripened cheese.

The authors conclude that: (1) The casein of milk which has been heated is so changed that it is not susceptible to ripening processes. (2) Although the ripening is due to lactic organisms, not every lactic-acid ferment can produce ripening. (3) The theory of Babcock and Russell is incorrect, otherwise the control cheeses should have ripened. (4) The theory of Weigmann, if correct, must be modified as to the dying of the micro-organisms, since the cheese used for inoculating the milk was 14 days old.

Dairy cows, G. HENRY (*Quebec Dept. Agr. Bul. 1, pp. 63, figs. 4*).—A popular discussion on the feeding and care of dairy cows and the improvement of herds.

Jersey cattle, their feeding and management (*London: Vinton & Co., 1898, pp. 57*).—This is a popular work prepared by the English Jersey Cattle Society.

Building, remodeling, and ventilating barns, F. H. KING (*Wisconsin Dairymen's Assoc. Rpt. 1899, pp. 151–163, figs. 4*).—A discussion of stables for dairy cows.

Dairying in Denmark, A. MONVOISIN (*Jour. Agr. Prat., 1899, II, Nos. 36, pp. 349–352; 37, pp. 388–391, figs. 8*).

Cooperative dairying in Belgium, M. BEAU and M. BOUGUERET (*Jour. Agr. Prat., 1899, II, No. 40, pp. 482–486*).

Milk: Its nature and composition. A handbook on the chemistry and bacteriology of milk, butter, and cheese, C. M. AIKMAN (*London: A. & C. Black, 1899, 2. ed., pp. XX+180*).

Contribution to the study of cow's milk, A. VAN ENGELEN and P. WAUTERS (*Bul. Agr. [Brussels], 15 (1899), No. 4, pp. 298–312*).—Determinations were made of the yield and composition of milk of 9 cows for one year. The results are given in tabular form and conclusions drawn. "Food has scarcely any influence on the composition of milk. . . . Richness depends primarily on individual aptitude, and has no relation to the quantity of milk produced."

Contributions on the spontaneous curdling of milk, Y. KOZANI (*Ztschr. Hyg. u. Infectionskrank., 31 (1899), p. 337; abs. in Chem. Ztg., 23 (1899), No. 52, Repert., p. 193*).—The kind of lactic acid present in spontaneously curdled milk is considered.

Report on sanitary and bacteriological work for the Department of Agriculture, A. L. HAINES (*Rpt. New York State Dept. Agr., 5 (1897), I, pp. 528–548, pls. 2*).—The author gives a summary account of his work in the State in the inspection of creameries, cheese factories, milk-shipping stations, dairy apparatus, dairy products, and the surroundings and food supplies of dairy animals, and describes a number of bacteria found in milk.

On the presence of tubercle bacilli in the commercial milk and butter in Turin, A. RONDELLI (*Riv. Ig. e San. Pubb., Roma, 9 (1898), No. 24, pp. 873, 874*).—The investigations were confined to milk. Endoperitoneal inoculations in 40 guinea pigs were made with commercial milk from 15 different sources. A number of the animals died suddenly, about 24 to 48 hours after the inoculation, with symptoms of intoxication from bacterial products or of acute infection by *Bacterium coli*. Of the 40 guinea pigs inoculated, only 2 died with generalized tuberculosis. The remainder were killed 6 months after the inoculation, and were found, on examination, to be in sound condition. The author concludes that the presence of the tubercle bacillus in the commercial milk of Turin is not of frequent occurrence, and that the milk is in quite satisfactory condition in this respect.

The development of the mechanical skimming method and its influence on Swedish dairying, K. F. LUNDIN (*K. Landt. Akad. Handl., 38 (1899), No. 3, pp. 127–153*).

A B C in butter making, J. H. MONRAD (*Winnetka, Ill., 1899, pp. 108, figs. 79*).—This is a quite elementary treatise designed, as the subtitle states, "for young creamery butter makers, creamery managers, and private dairymen."

Tests of a new butter ferment, F. D. CHESTER (*Delaware Sta. Rpt. 1898, pp. 47–49*).—Butter was made from cream ripened with *Micrococcus butyri-aromafaciens* and compared with creamery butter. As regards both flavor and keeping quality, the evidence of experts was slightly in favor of the ferment butter. The advantages in the use of a good butter ferment as compared with the fortuitous ripening of cream are noted.

The trials of cream separators at Maidstone, R. M. GREAVES and J. A. VOELCKER (*Jour. Roy. Agr. Soc. England, 3. ser., 10 (1899), pt. 3, pp. 525–545, figs. 6*).—Detailed results of tests of 6 power and 9 hand separators.

Seventh annual report of Wisconsin Cheese Makers' Association, 1899 (*Wisconsin Cheese Makers' Assoc. Rpt. 1899, pp. 210, figs. 39*).—Among the papers contained in the report are the following: The foreign cheese business in Wisconsin, J. W. Decker; Cost of milk and butter production, T. L. Haecker; Modern improved methods of cheese making, D. M. MacPherson; The construction of curing rooms from a practical standpoint, F. H. King.

Stilton cheese, J. M. DUGDALE (*Jour. Roy. Agr. Soc. England, 3. ser., 10 (1899), pt. 2, pp. 351–370, figs. 5*).—The author reviews the history of Stilton cheese and describes the method of manufacture as observed by him in Leicestershire and elsewhere, and points out certain causes of failure.

Influence of temperature on the ripening of cheese, E. CASTEL (*Jour. Agr. and Hort., 3 (1899), Nos. 6, pp. 142–144; 7, p. 163*).

How to construct a subearth duct, J. W. DECKER (*Wisconsin Dairymen's Assoc. Rpt. 1899, pp. 127–134*).—Notes on the construction, advantages, and cost of subearth ducts.

Dairy products of Canada, J. L. BITTINGER (*U. S. Consular Rpts., 1899, No. 224, pp. 17–32*).—A statistical review of the production of butter and cheese in Canada, with a summary of dairy legislation.

The value of skim milk, W. A. HENRY (*Wisconsin Dairymen's Assoc. Rpt. 1899, pp. 97–102*).—Discusses the value of skim milk for feeding calves and pigs.

VETERINARY SCIENCE AND PRACTICE.

The preparation and use of tuberculin, E. A. DE SCHWEINITZ (*U. S. Dept. Agr. Yearbook 1898, pp. 111–120, pl. 1*).—The author gives a detailed description of the method used in the laboratory of the Bureau of Animal Industry in the preparation of tuberculin, and general directions for its use.

The culture medium is made in the following manner: One pound of meat and 1 liter of water, to which is added 1 per cent of peptone, 0.25 per cent of salt, and 7 per cent of glycerin. The solution is boiled, filtered, and placed in sterilized flasks. The solution in the flask is then inoculated. The tubercle germs introduced must be deposited carefully upon the surface, where they are allowed to increase until the surface of the medium is covered. The flasks are then shaken gently, so that all but a small patch of the germs fall to the bottom. The remaining germs are allowed to multiply until the surface is again covered, and this process is repeated until the medium is thoroughly filled with the germs. The flask is then sterilized by heating at a temperature of 125° C. The contents of the flask are filtered and the filtrate concentrated to about one-fifth of its original value.

The tuberculin sent out from the laboratory for immediate use is diluted to such a degree that 2 cc. of the diluted tuberculin is a proper dose for an animal of 1,000 lbs. weight.

The author gives a general table of directions for guiding State veterinarians and other persons who are using the tuberculin test in the taking of the temperatures before and after injection of the tuberculin.

The question of the diagnostic value of tuberculin is discussed, and the author maintains that from general results thus far obtained tuberculin is for all practical purposes an infallible test, there having been reported but very few cases of doubtful or misleading results from its use.

Cattle dipping, experimental and practical, V. A. NÖRGAARD (*U. S. Dept. Agr. Yearbook 1898, pp. 453–472, figs. 2*).—This paper contains a detailed account of the experiments which led to the discovery of an effective cattle dip for destroying the cattle tick (*Boophilus bovis*).

The first remedies which were tried, carbolic acid and corrosive sublimate, were not at all satisfactory for the reason that they were too strongly irritant upon the skin of cattle and not effective in destroying the ticks.

Cotton-seed oil, the next remedy to be applied, was floated on the surface of the water in the dipping vat, the oil forming a layer of about 2 to 3 in. in depth. It was found that many of the ticks survived this treatment and at the same time that the oil had a decided heating effect upon the cattle. Paraffin oils of less and less specific gravity were used in succession, and finally sulphur was added to the oil, but still without perfectly satisfactory results. Some ticks always survived the treatment, and the cattle suffered to a greater or less extent.

The dipping solution which proved most satisfactory was a so-called dynamo oil of very light specific gravity, free from acid, and containing less paraffin and more of the volatile substances than the other oils which had been used. To this oil sulphur was added, and from a series of experiments it was found that all ticks were destroyed by a single dipping.

The author gives the history of the experiments by means of which it was shown that cattle taken from below the quarantine line and dipped in the solution just described could be safely transferred immediately after dipping to States north of the quarantine line and allowed to mingle freely with cattle which had never had Texas fever, without danger of communicating the disease. During these experiments it was noticed that some cattle which appeared free from the disease suffered an acute attack of Texas fever in consequence of dipping. The disease is apt to undergo a recrudescence from severe exposure.

Remarks on anthrax and rabies with special reference to outbreaks recently investigated, V. A. MOORE (*Rpt. New York State Dept. Agr., 5 (1897), I, pp. 549–566, pls. 3*).—An outbreak of anthrax, during which several cows died at Elmira, was investigated. The origin of the infection was not learned. The preventive treatment adopted was the method recommended by Touissant. Defibrinated blood was drawn from an animal immediately after death, thoroughly heated in an autoclave, strained, and filtered. Four cubic centimeters of this sterilized blood preparation was injected into each of the well animals and into 3 cows which already showed signs of the disease. None of the well animals showed any elevation of temperature, and the 3 sick ones subsequently recovered. This method is considered under certain circumstances even superior to that of Pasteur.

The bacillus of anthrax (*Bacillus anthracis*) is described, with various biological notes, and is distinguished from the bacillus of symptomatic anthrax and from *B. subtilis*.

A report is made on an investigation of two outbreaks of rabies, during which several dogs, cows, horses, and one man died. Attention is called to the importance of careful examination and diagnosis of the disease in case of the death of a dog with symptoms of rabies. This is necessary in order that proper treatment may be given other animals and human beings which may have been bitten by the dog.

A report concerning the nature of infectious swine diseases in the State of New York, with practical suggestions for their prevention and treatment, V. A. MOORE (*Rpt. New York State Dept. Agr., 5 (1897), I, pp. 567–619, pls. 5*).—The author gives a historical sketch of the early literature of swine diseases in this country, and the synonymy of names which are used for the same diseases in European countries.

The symptoms, morbid anatomy, and appearance of the diseased organs are described at some length. The usual remedies and preventive measures, including the serum treatment, are described and urged upon the farmers for use.

The two diseases swine plague and hog cholera are separately described and distinguished one from another. The section of the report dealing with serum therapy in swine diseases is practically the same as the article by the author which is abstracted in E. S. R., 10, p. 693.

Accounts are given of investigations of outbreaks of swine diseases in New York, one of which was not well determined; the second was due to filthiness of the food among some swill-fed hogs, and a few outbreaks were due to a combination of hog cholera and swine plague.

Detailed descriptions are added of the morphology, biochemic properties, thermal reactions, and pathogenesis of the bacillus of hog cholera and of the bacillus of swine plague, and for convenience of comparison, the characteristic properties of these two bacteria are arranged in parallel columns.

Nenta, D. Hutcheon (*Agr. Jour. Cape Good Hope, 14 (1899), No. 13, pp. 862–873, figs. 3*).—Nenta is a disease of goats which has been called by other names, such as cerebro-spinal meningitis and Krimpziekte. It has been attributed to various plants of the earlier Leguminosæ and other families. A number of observers have suspected *Lessertia annularis* as being the cause of the disease. The author made experiments in feeding dogs with portions of the body of goats affected with the disease. It was found that dogs, when fed with an extract of the stomach contents of the goat, contracted the disease within a few hours. The disease could also be transmitted from one goat to another in the same manner. No specific germ of the disease was discovered, although it was strongly suspected that such a germ would be found. The cause of the disease is believed to be the plant *Cotyledon ventricosa.* Various experiments made in feeding goats portions of the plant and extracts from the plant were attended with constant and positive results. All goats so fed acquired the disease.

The symptoms of the disease are difficulty in traveling, staggering gait, shivering, and difficult breathing. When lying down, the goats throw the head back upon the side of the body. When large quantities of the plant are eaten a severe tympanitis is apt to follow besides the other symptoms. No specific antidote for the poison has been found and no treatment has been devised which may be considered curative. The author found, however, that full doses of epsom salts, followed by chloral hydrate, repeated 3 or 4 times a day, had good effects in the milder cases. On farms where this plant has been exterminated the disease has completely disappeared.

The International Veterinary Congress in Baden-Baden, Peter and Jess (*Berlin. Tierärztl. Wchnschr., 1899, Nos. 32, pp. 383–385; 33, pp. 395–401*).—A general account of this meeting and of the subjects discussed.

Aphthous fever, Weber (*Rec. Méd. Vét., Paris, 8. ser., 6 (1899), No. 16, pp. 303–313*).—A study of the disease and particularly of the milk during the progress of the dis-

Aphthous fever, A. Simoes (*Arch. Rural, Portugal, 4 (1899), Nos. 3, pp. 41–43; 6, pp. 91–93*).—Contains a description of the disease and recommends disinfection by corrosive sublimate.

A bacillus resembling anthrax from a suspected case of anthrax, F. D. Chester (*Delaware Sta. Rpt. 1898, pp. 52–55*).—Cultures were made of bacillus from an animal which died apparently from anthrax. The bacillus closely resembles that of anthrax, but differs from it in its behavior on different culture media, and is therefore considered a new species—*Bacillus anthracis similis.* The bacillus did not produce any pathological results when injected into mice.

On the presence of specific agglutinins in bacterial cultures, E. Malvoz (*Ann. Inst. Pasteur, 13 (1899), No. 8, pp. 630–636*).—Specific agglutinating substances are supposed by authors generally to be developed by the reactions of the organism. These reactions are usually attributed to the influence of some microbe or to a normal physiological activity of the host organism. The author's investigations led him to believe that it is unnecessary to assume the existence of normal or pathological secretions in order to explain the agglutinating power of serums. In making cultures of anthrax bacillus the author found specific agglutinating substances in the cultures themselves and believes this may be true in the case of other bacteria.

Study of the relationship between agglutinins and lysins in anthrax, O. GENGOU (*Ann. Inst. Pasteur, 13 (1899), No. 8, pp. 642–656*).—In this paper the author discusses the agglutinating power of normal serum and of the serum of immunized animals. The agglutinating power is specific and is not transmitted to offspring. The agglutinins can pass through the walls of blood vessels, but are not dialyzed through a collodion sack when placed in the peritoneal cavity of an immunized animal. There is no relationship between the germicidal power of a serum and its agglutinating power. The specific agglutinating serum is not more strongly germicide than normal blood. The author believes that there is no direct relationship between the agglutinating property of serums and leucocytosis. It was impossible to show that any organ of the body was directly concerned in the production of agglutinating substances.

Tuberculosis and the tubercle bacillus, I. STRAUSS (*La tuberculose et son bacille. Paris: Rueff & Co., 1895, pp. 884, figs. 72*).—This work discusses in a thorough manner all of the topics connected with the study of tuberculosis, including the morphology, culture, and biology of the tubercle bacillus, the tuberculosis of different animals, the methods of contagion, attempts at immunization, tuberculin, and a clinical study of its effects.

Tuberculosis in dairy cattle, and how shall we get rid of it, N. E. REINHART (*Jour. Comp. Med. and Vet. Arch., 20 (1899), No. 7, pp. 413, 414*).—Recommends the tuberculin test for all dairy herds.

Tuberculosis problems before the Seventh International Veterinary Congress, G. REGNER (*Landtmannen, 10 (1899), No. 36, pp. 579–581*).—An account of the discussion concerning methods of transmission of tuberculosis, and of means for combating it.

A case of tuberculosis, W. SOMERVILLE and A. MEEK (*Veterinarian, 72 (1899), No. 861, pp. 635–637*).—Animals suffering from acute tuberculosis may be closely associated with other animals without communicating the disease.

Investigations on the milk of cows which react to the tuberculin test but show no clinical symptoms of tuberculosis, OSTERTAG (*Ztschr. Fleisch u. Milchhyg., 9 (1899), No. 12, pp. 221–232*).—A large series of experiments failed to show any tubercle bacilli in the milk of such cows.

Artificial tuberculin, GÖRIG (*Deut. Tierärztl. Wchnschr., 7 (1899), No. 37, pp. 325, 326*).—Two injecting fluids claimed by Sirot to be good substitutes for tuberculin were tried on 12 animals with entirely negative results.

Vaccination against blackleg, N. NOTARNICOLA (*Giorn. R. Soc., Accad. Vet. Ital., 48 (1899), No. 29, pp. 679–682*).—A description of the technique and an account of the effectiveness of the operation.

Blackleg vaccine, E. P. NILES (*Virginia Sta. Bul. 90, pp. 67–77, figs. 2*).—The bulletin contains directions for the guidance of stockmen in the preparation of vaccine from the dried material and for the care and use of the hypodermic syringe, the choice of a place for giving the inoculation, the dose, and methods of securing the animal to prevent accidents.

Rinderpest, D. HUTCHEON (*Agr. Jour. Cape Good Hope, 14 (1899), No. 12, pp. 773–781*).—Inoculation with the bile of infected animals is recommended for giving immunity, and directions are given for preparing the bile and making the inoculations.

Texas fever problems—V, D. E. SALMON (*Breeders' Gaz., 35 (1899), No. 1, pp. 5, 6*).—Urges farmers to look forward to the extermination of the cattle tick. By keeping all cattle out of infested pastures for about 2 years the pastures are rendered safe and free from ticks.

The actinomyces group and the bacteria related to it, E. LEVY (*Centbl. Bakt. u. Par., 1. Abt., 26 (1899), No. 1, pp. 1–11*).—This paper discusses the morphological relationships of actinomyces and the bacteria which are usually classified with it to bacteria which have similar microscopic and physiological characters. Actinomyces is considered to be closely related to the bacillus of glanders and tuberculosis.

Investigations in the control of foot and mouth disease, HECKER (*Berlin. Tierärztl. Wchnschr., 1899, No. 34, pp. 407–411*).—This paper contains a discussion of the method of contagion and the technique of the preparation of immunizing serum. According to the author the healthy skin is not affected by the contagium.

Preventive inoculation against foot and mouth disease, F. LÖFFLER (*Deut. Tierärztl. Wchnschr., 7 (1899), No. 36, pp. 317–320*).—The technique of the serum preparation is given. Good results were obtained. Experiments were made to determine the duration of the immunity.

Report on the outbreak of foot and mouth disease which occurred in Sweden during 1897 and 1898, J. LUNDGREN (*Meddel. K. Med. Styr., 1898, No. 31, pp. 1–24*).—In this pamphlet an account is given of the supposed origin of this outbreak of the disease, together with detailed directions for disinfecting the stables and the clothes of the attendants.

Contagious abortion in cows, J. LAW (*Rpt. New York State Dept. Agr., 5 (1897), I, pp. 620–636*).—This paper contains a discussion of the different forms of abortion, such as those caused by ergot, smut, etc., and the contagious forms of the United States and Europe. The author considers the various means of transmission of the disease, and discusses the evidence in favor of the disease being contagious. A scheme of prevention and treatment is outlined.

Serum inoculation, O. SCHREIBER (*Berlin. Tierärztl. Wchnschr., 1899, No. 37, p. 449*).—The serum of animals which are immunized against hog cholera was found to give immunity against chicken cholera also.

Acute glanders in the stables of the street railway companies of Utrecht, J. VAN ZIJVERDEN (*Tijdschr. Veeartsenijk. en Veeteelt, 26 (1899), No. 5, pp. 363–372*).—A discussion of outbreaks of glanders with tables showing the temperature records of horses which were tested with mallein.

Report of the glanders committee appointed by the Board of Agriculture, J. A. W. DOLLAR (*Veterinarian, 72 (1899), No. 861, pp. 657–669*).—A discussion of the mallein tests and recommendations as to the slaughter of glanderous horses.

On the use of the silver preparation of Credé as a means for diagnosing glanders, A. BALDONI (*Clin. Vet., 22 (1899), No. 32, pp. 373–380*).—A discussion of the method of applying this diagnostic agent, and statement of results obtained.

Equine distemper, C. MCCULLOCH (*Virginia Sta. Bul. 89, pp. 57–65*).—This bulletin gives a brief account of the disease known as horse distemper, including its history, etiology, symptoms, course, pathological anatomy, and treatment.

Bacteriological investigations on a chicken epizootic of recent occurrence, C. MAZZA (*Centbl. Bakt. u. Par., 1. Abt., 26 (1899), No. 6, pp. 181–185*).—By experimental cultures and inoculations the author was able to determine that the micro-organism which caused this disease differed in several particulars from the bacillus of chicken cholera.

The parasitic diseases of poultry, F. V. THEOBALD (*Offic. Rpt. National Poultry Conference, Reading, July, 1899. London: E. Arnold, pp. 28–40*).—This article contains a general description of the diseases of poultry caused by bird lice, mites, the gapeworm, and plant parasites.

On a recent epizootic of chickens in Lombardy, S. BELFANTI and C. ZENONI (*Clin. Vet., 22 (1899), No. 34, pp 397–402*).

The hydrotherapy of domestic animals, STIETENROTH (*Berlin. Tierärztl. Wchnschr., 1899, No. 17, pp. 205–206*).—A general account is given of the value of a cold-water treatment for local fever conditions, especially in the case of the horse. The various uses of hot and cold water irrigation for digestive disorders are discussed as well as the value and effects of hot and cold baths for animals.

Deadly nightshade, or belladonna, G. C. KESLER (*Jour. Comp. Med. and Vet. Arch., 20 (1899), No. 8, pp. 491, 492*).—Gives symptoms and treatment in case of poisoning of sheep by this plant.

The antiseptic power of iodoform, A. FONSECA (*Compt. Rend. Soc. Biol. Paris, 11. ser., 1 (1899), No. 23, pp. 590, 591*).—Records the germicide power of iodoform as shown in experiments with a number of bacteria.

Chinosol as a disinfectant, E. TURKIN (*Arch. Vet. Nauk, St. Petersburg, 29 (1899), No. 5, pp. 265–281*).—The article contains a discussion of the physical characters of chinosol, its toxic activity, checking influence of chinosol upon the growth of bacteria, its disinfectant and germicidal character, its clinical application, and a record of a large number of experiments in which different bacteria were exposed to its action.

Protargol, H. GIESECKE (*Berlin. Tierärztl. Wchnschr., 1899, No. 26, pp. 311, 312*).—A silver preparation which it is claimed contains silver in organic union with a proteid molecule. In 0.25 per cent to 2 per cent solutions it is useful for treating conjunctivitis and fistula.

Russian waters (blister fluid), VOIGT (*Berlin. Tierärztl. Wchnschr., 1899, No. 26, pp. 312–314*).—A new skin irritant useful in treatment of contusions, œdematous swellings, and blood extravasations.

Contributions to the toxicology of ricin, F. MÜLLER (*Arch. Exper. Path. u. Pharmakol., 42 (1899), No. 2–4, pp. 302–322*).—The poisonous principle of ricin is said not to be affected by the action of the digestive juices, and is therefore not considered a nitrogenous substance. The action which ricin has of causing red blood corpuscles to fuse together is destroyed if the ricin is acted upon by the digestive juices. Its poisonous action is therefore not directly upon the red corpuscles.

STATISTICS—MISCELLANEOUS.

Tenth Annual Report of Delaware Station, 1898 (*Delaware Sta. Rpt. 1898, pp. 268*).—Financial statement for the fiscal year ended June 30, 1898; organization list of the station; a brief review of station work by the director; and reports of the mycologist, chemist, horticulturist, entomologist, and meteorologist, containing articles noted elsewhere. The report also includes reprints of Bulletins 38, 39, 41, and 43 of the station on the following subjects: Some principles in Delaware apple culture (E. S. R., 10, p. 354); sorghum, its development as a commercial source of sugar (E. S. R., 10, p. 345); the European and Japanese chestnuts in the eastern United States (E. S. R., 10, p. 962); veterinary studies; State and municipal milk legislation; the use of basic slag as a fertilizer in hay farming (E. S. R., 11, pp. 141, 185, 189).

Annual Report of Pennsylvania Station, 1897–98 (*Pennsylvania Sta. Rpt. 1897–98, pp. 346*).—The report covers the 18 months ended June 30, 1898, and contains the organization list of the station; financial statements for the fiscal years ended June 30, 1897 and 1898; a report of the director reviewing the work of the station in soils and fertilizers, horticulture, and stock feeding and dairy husbandry; a general discussion on the computation of rations for farm animals reprinted from the Annual Report of the Station for 1896 (E. S. R., 9, p. 873); several articles noted elsewhere; exchanges, and a subject list of station publications. Reprints are also included of Bulletins 39–43 of the station on the following subjects: Variety tests of wheat, oats, and potatoes (E. S. R., 10, p. 41); the sugar beet in Pennsylvania (E. S. R., 10, p. 40); the comparative value of buckwheat middlings, dried brewers' grains, and Cerealine for milk and butter production (E. S. R., 10, p. 589); the maintenance ration of cattle (E. S. R., 10, p. 1079), and apples in Pennsylvania (E. S. R., 10, p. 1042).

Ninth Annual Report of Utah Station, 1898 (*Utah Sta. Rpt. 1898, pp. XLII*).—This contains a report of the director on the work, publications, staff, and equipment of the station; reports of the different departments, parts of which are noted elsewhere; a financial statement for the fiscal year ended June 30, 1898; a list of periodicals received, and a subject list of the bulletins issued by the station, An index to the annual report and bulletins issued during the year accompanies the report.

Yearbook of the Department of Agriculture, 1898 (*U. S. Dept. Agr. Yearbook 1898, pp. 768, pls. 41, figs. 136*).—This consists of a general report by the Secretary on the operations of the Department during the year; 36 miscellaneous articles noted elsewhere; and a summary of useful information published in the form of an appendix. In addition to the usual statistical matter the appendix of the present Yearbook contains a more extended agricultural directory and an account of Cuba and the Philippine Islands.

Report of the State experiment station at Gembloux for 1898, A. PETERMANN (*Bul. Agr. [Brussels], 15 (1899), No. 4, pp. 221–237*).—A report on the work of the station with a summary of the results obtained.

Farming in North Carolina, W. F. MASSEY (*North Carolina Sta. Bul. 162, pp. 227–257*).—This is a popular bulletin designed to give suggestions as to the more profitable uses of the soil and crops of the State, and includes a discussion of the use of commercial fertilizers, home-mixing of fertilizers, care of home-made manures, Piedmont red clay and its improvement, the treatment of the sandy lands of the coast region, culture of cotton and corn, the cowpea and its value in the acquisition of nitrogen, curing the cowpea for hay, the importance of stock feeding, the capacity of the black-pea soils of eastern North Carolina for stock feeding, making and care of pastures, hog raising, curing hams and bacon, trucking as an adjunct to general farming, and other topics.

Agricultural experiments in Alaska, C. C. GEORGESON (*U. S. Dept. Agr. Yearbook 1898, pp. 515–524, pls. 2, map 1*).—This is a popular account of experimental work in Alaska reported in greater detail in Office of Experiment Stations Bulletin 62 (E. S. R., 11, p. 42).

The Hawaiian Islands, W. MAXWELL (*U. S. Dept. Agr. Yearbook 1898, pp. 563–582*).—The agricultural conditions and possibilities of the islands are discussed under the following headings: Area and population, climatic conditions, soils, products, new cultures and industries, forests, ranches, dairying, and labor conditions.

Agriculture in Puerto Rico, R. STONE (*U. S. Dept. Agr. Yearbook 1898, pp. 505–514, map 1*).—A popular description of the conditions and methods of agriculture in the island.

Puerto Rico, its conditions and possibilities, W. DINWIDDIE (*New York: Harper Bros., 1899, pp. 293, ill.*).

Notes on the plant products of the Philippine Islands, F. H. HITCHCOCK (*U. S. Dept. Agr., Division of Botany Circ. 17, pp. 8*).—In order to supply a demand for popular information relative to the plant products of the Philippines, the author has translated a consular report by M. de Bérard published in *Bul. Consulaire Français, 22 (1891), pt. 6.* The data relating to exports are drawn from U. S. Dept. Agr., Section of Foreign Markets Bulletin 14.

The public domain of the United States, M. WEST (*U. S. Dept. Agr. Yearbook 1898, pp. 325–354*).—The public domain of the United States is described by States and Territories and a summary given of the various acts of Congress under which vacant public lands are open to settlement. Exclusive of Alaska and the new island possessions, the total area of vacant Government lands is placed at 573,995,000 acres, and of Government reservations at 145,122,000 acres. Estimates are given on the area of public lands reclaimable by irrigation. Tables show the areas of vacant, reserved, and appropriated lands and the classification of lands reserved from settlement in each State.

Notes on some English farms and farmers, G. W. HILL (*U. S. Dept. Agr. Yearbook 1898, pp. 583–589*).—A brief description of general farm conditions in the counties of Leicester and Rutland, England, and of a number of individual farms in the same counties.

L'Armagnac; its soils, vineyards, brandies, and lands, F. BERTHAULT (*Ann. Agron., 25 (1899), No. 9, pp. 421–447*).—Data on the agricultural conditions of this region are reported and discussed.

Press Bulletins Nos. 1 to 34 (*Kansas Sta. Bul. 86, pp. 62*).—This is made up of reprints of weekly press bulletins issued by the station from August 2, 1898, to April 7, 1899. The articles are based largely on the results of experiments at the station. Following are the subjects treated: Wheat experiments, keeping milk in hot weather, the fringed-wing apple-bud moth, soil moisture and soil stirring, blackleg, the sand plum, Kafir corn for fattening pigs, some reasons why fruit does not set, the peach twig-borer, fall preparation for alfalfa seeding, celery, the balanced ration, seed breeding, the fruit-tree bark-beetle, Kansas sugar beets for 1898, actinomycosis, hardy ornamental shrubs, notes on weeds, the potato-stalk weevil, possibilities in corn improvement, winter protection of peach buds, grazing grasses of western Kansas, the spring cankerworm, a new crop for Kansas farmers, alfalfa hay for fattening hogs, *Tænia fimbriata* (fringed tapeworm), sugar-beet experiments for 1899, treatment of winter-injured trees, milking scrub cows, lice on animals, potato scab, get ready for the drought.

Agricultural articles in the Russian press during 1898 and 1899. I, The present condition of agriculture, S. KIZENKOV (*Selsk. Khoz. i Lyesov., 193 (1899), June, pp. 663–708*).

Outline of instruction given at the agricultural institute at Gembloux (*Bul. Agr. [Brussels], 15 (1899), No. 4, pp. 164–171*).

Some types of American agricultural colleges, A. C. TRUE (*U. S. Dept. Agr. Yearbook 1898, pp. 63–80, pls. 7*).—The institutions in the United States in which agricultural instruction of college grade is provided are divided into 3 classes: (1) Colleges having only courses in agriculture; (2) colleges having courses in agriculture along with those in a variety of subjects, including especially mechanic arts; and (3) colleges (or schools or departments) of agriculture forming a part of universities. The chief characteristics of the different classes are brought out by descriptions of a number of institutions. The Massachusetts Agricultural College is described as the only exclusively agricultural college in the United States. The Michigan State Agricultural College, Mississippi Agricultural and Mechanical College, Kansas State Agricultural College, Iowa State College of Agriculture and Mechanic Arts, Pennsylvania State College, and the Alabama Polytechnic Institute are taken as types of the agricultural and mechanical colleges. Of the State universities having courses in agriculture Cornell University, Ohio State University, University of Wisconsin, and the University of California serve as typical institutions. Some features of student life in the colleges and State universities are noted.

Construction of good country roads, M. O. ELDRIDGE (*U. S. Dept. Agr. Yearbook 1898, pp. 317–324, pls. 2*).—The general principles of road construction and maintenance are discussed, the following topics being treated: Location, grades, drainage, surfacing, earth roads, gravel roads, stone roads, macadam and telford roads, and road maintenance.

Steel-track wagon roads, M. DODGE (*U. S. Dept. Agr. Yearbook 1898, pp. 291–296, pls. 3, fig. 1*).—The merits of this kind of road are discussed, directions for construction are given, and tests of the road at the Trans-Mississippi Exposition at Omaha are reported.

NOTES.

Alabama College Station.—R. W. Clark and Moses Craig have been appointed assistants in agriculture and horticulture, respectively.

Nebraska Station.—The terms of office of Thomas Rawlings and Charles Weston as regents of the university have expired. Their successors, chosen at the November election, are Edson C. Rich, 1537 Park avenue, Omaha, and John L. Teeters, 139 North Ninth street, Lincoln. Vergil C. Barber, assistant animal pathologist of the station, has resigned to accept a position with a business firm of Chicago.

New Mexico Station.—The programme of work for the coming year consists more largely than ever before of work upon the various problems connected with the use of water in New Mexico agriculture. At a recent meeting of the board, the director of the station was authorized to take up the matter of adding an irrigation engineer to the station staff. T. D. A. Cockerell has been invited by the director of the Arizona Station to spend a month in Arizona working up certain insect problems in the southern part of that Territory. A farmers' institute has been held in the San Juan Valley, in the northwestern part of the Territory, under the management of C. E. Mead, superintendent of the substation at Aztec. This substation and the two others in the Territory now receive a special appropriation of $1,000 each per annum from the Territorial funds.

Ohio Station.—Chas. W. Mally, assistant entomologist, has been appointed assistant to the government entomologist of Cape Colony, South Africa, and Wilmon Newell. assistant entomologist at the Iowa Experiment Station, has been appointed in his place.

Tennessee Station.—Weston M. Fulton, United States weather observer at Knoxville, has recently been appointed meteorologist to the station. The station staff is cooperating with the State bureau of agriculture in holding farmers' institutes over the State. Much enthusiasm is manifested in the work of the station.

Texas College and Station.—The title of the horticultural department in the college and station has been changed to that of horticulture and mycology. Assistant H. Ness has been made professor of botany, and A. M. Ferguson has been elected assistant in the department of horticulture and mycology. The foundation for the new agricultural and horticultural building has been laid. The building will be two stories, 72 by 172 ft., with a meteorological observatory 60 ft. above ground. Provision is made for the teaching and investigation of the agricultural and horticultural departments of the college and station, and the general offices of the station will also be located in this building.

Wyoming University and Station.—At the semiannual meeting of the board of trustees of the university, held December 4, plans were adopted for a new science hall, which will be erected the coming season. The building will cost $35,000 and be so constructed that wings can be added as more money is available. The part to be built next season will accommodate the museum and the biological and chemical departments. This will provide much needed room for the station laboratories and relieve the present crowded condition in the main university building.

Alaska Stations.—Prof. C. C. Georgeson, in charge of the Alaska experiment stations, has returned to Washington to present his report of the past season's operations, and for consultation as to plans for future work. The first year has been quite largely occupied in the preliminary work of clearing land, erecting buildings, and getting some cooperative work started in different places. Several acres of land have been cleared on the reservations at Sitka and at Kenai. A two-story frame building to serve as headquarters for all the stations has been erected and partially completed at Sitka, and log barns, implement sheds, and silos for preserving the native grass have been built at both Sitka and Kenai. Further experiments in growing grains and vegetables have been made at Sitka. Kenai, and Kadiak The results of these experiments were even more encouraging than those of the preceding year. Some half dozen varieties of spring wheat, a dozen varieties each of barley and oats, and also flax and Siberian buckwheat all matured at Sitka. At the Kenai station the experiments were equally successful, although carried out on a smaller scale. There was no old ground available at that place; a piece had therefore to be cleared and broken before any seeding could be done, but, in spite of late seeding, Mr. H. P. Nielsen, who was in charge of the work there, succeeded in maturing samples of wheat, barley, oats, buckwheat, and flax. At both places most of the hardy vegetables were also grown successfully. Some heads of cauliflower grown at Kenai measured more than 12 in. across, and ruta-bagas attained a weight of 10 lbs. It is planned to make some reservations of land in the interior the coming summer, and to institute similar tests there. At the coast stations several lines of experiments will be inaugurated. Chief among them will be the problems incident to the bringing of raw land into condition for culture in that region, also the selection and development of varieties of cereals suited to Alaska conditions.

MISCELLANEOUS.—Dr. M. Hollrung, director of the experiment station for plant protection at Halle, Germany, has begun the publication of a yearly review of the literature relating to plant diseases and their prevention. He is desirous of obtaining all publications relating to the subject. Reprints, excerpts, etc., may be sent to him at Halle a. S., Germany. The first volume of this annual, which reviews the literature of 1898, contains 184 pages and gives quite full abstracts of much of the literature which appeared during the year. A brief review of the legislation and decrees of various countries to prevent the introduction and spread of various insect and fungus pests is given. The distribution of some diseases and injurious insects is noted, and publications relating to a number of insects, fungi, weeds, etc., are reviewed without reference to host plants. The principal part of the work is taken up with reviews of literature relating to various fungus diseases and destructive insects, together with suggested means for their suppression. The principal groupings are: Injuries to cereals, fodder grasses, root crops, garden crops, large and small fruits, grapes, and forest trees. The means described for protection are classed as natural and artificial, the latter being divided into mechanical and chemical methods. An index of literature completes the volume.

According to the Bulletin of Miscellaneous Information of the Botanical Department of Trinidad, for October, 1899, the government has decided to establish a course of elementary agriculture in the rural schools. In order to prepare the necessary teachers, it was decided to institute a three weeks' course, the time to be equally divided between the experiment station at St. Clair and the government laboratory. This course was held during August and was remarkably successful. Twenty teachers attended classes, seventeen of whom reported for examination. The course was conducted by Director Hart, assisted by Mr. William Leslie, and consisted of lectures and practical demonstrations of the chief points of agricultural theory and practice.

Dr. L. Hiltner, formerly connected with the experiment station at Tharand, Saxony, entered upon his duties in the bacteriological laboratory of the Imperial Health Department, at Berlin, on November 1, 1899.

Dr. J. M. Jause, formerly of Buitenzorg, has been called to the chair of botany in the University of Leyden.

EXPERIMENT STATION RECORD.

VOL. XI. No. 6.

For nearly a century some form of apparatus for measuring and analyzing the products of respiration has been recognized as desirable in studying the fundamental laws of nutrition, and for the past 40 or 50 years it has been regarded as of prime importance. From the imperfect and crude forms of apparatus at first devised for this purpose the respiration apparatus has been developed until it may be said to be an instrument of precision, complicated in its construction, but so perfect and reliable in the performance of its work as to make its measurement and determination of the respiratory products comparable in accuracy with those ordinarily made in laboratory analysis.

In the course of its development this apparatus has passed through various stages, which it may be of interest to trace briefly. It is not known definitely who first conceived and constructed a respiration apparatus, but Lavoisier, who first explained the nature of respiration, used simple forms of apparatus for measuring and determining the respiratory products and the heat given off by the body in short intervals. His results were published in 1789.

In 1809 Allen and Pepys constructed a simple form of the ventilated-chamber apparatus, for experiments with guinea pigs, in which fresh air was constantly supplied. This consisted of a bell jar through which air was drawn with an aspirator, the carbon dioxid and water being determined in the outgoing air. A similar apparatus was employed by Boussingault in his experiments, published in 1844. The first apparatus of this type for experiments on human subjects was that used by Scharling (1843). The air current was very slow, however, and on account of the accumulation of carbon dioxid in the chamber experiments could not be continued for more than an hour.

An apparatus of a different type was employed by Regnault and Reiset, who published the results of a large number of experiments with small animals in 1849. In their apparatus, which has sometimes been called a closed-circuit apparatus, the same air was passed through the respiration chamber again and again, the carbon dioxid being absorbed and an equal volume of pure oxygen added to the air. Subsequently (about 1863) they enlarged their apparatus so as to make it applicable to experiments with swine, sheep, and calves.

The ventilated-chamber apparatus received its greatest development at the hands of Pettenkofer, who constructed a large apparatus for experiments on man. This apparatus was described in 1862. Pettenkofer, instead of passing the whole air current through the absorption apparatus, extracted aliquot samples for analysis. This enabled him to use a ventilating current of sufficient volume to maintain an atmosphere of normal composition in the respiration chamber. The substitution of baryta water for caustic potash as absorbing agent enabled him to obtain much more accurate estimations of carbon dioxid than any of his predecessors.

The Pettenkofer apparatus was adapted to experiments with large animals and used by a number of German investigators, notably Henneberg and Stohmann, Grouven, and Kühn. It was adapted to experiments with dogs and other small animals by Voit. Considerably later Tigerstedt constructed a very large respiration apparatus of this type, in which, in addition to the carbon dioxid, he attempted to determine the moisture of the air by means of hydrometer, psychrometer, and dew-point apparatus. The error in the measurement of water was about 7 per cent.

The ratio between the oxygen consumed and the carbon dioxid excreted (respiratory quotient), which has been found to be a delicate index of the changes going on in the body, has been arrived at with another form of respiration apparatus, in which the respiration chamber is practically eliminated. In place of the latter a sort of mask is worn in experiments with man, the mask being provided with valves and connected with suitable devices for measuring and analyzing the incoming and outgoing air. In experiments with animals a tube is often inserted in the trachea, through which the subject must breathe, and this tube is connected with a device for measuring and analyzing the inspired and respired air. Zuntz has used apparatus of this form quite extensively in experiments with both man and animals. In his apparatus for the investigation of human respiration the analytical apparatus is attached to the shoulders of the subject and carried about by him, so that experiments can be made under a great variety of conditions.

None of the forms of apparatus mentioned above take account of the heat given off from the body of the subject, but this has been found an important factor in studying the economy of food in the body. A number of different forms of calorimeters for use with small and large animals and with man have been devised from time to time. The earliest was probably that of Crawford (1779), followed later by those of Despretz and Dulong. All three of these were water calorimeters, the chamber being surrounded by a water jacket of known volume, which absorbed the heat radiated by the animal's body. Other forms were devised of the so-called emission type, of which the air calorimeter is a variety; the vaporization calorimeter, in which such liquids as aldehyde and ether were used and the amount volatilized measured; and the form in which the heat given off was measured by the amount of ice melted. An elaborate water calorimeter, suitable for experiments with animals, was devised by Pashutin, of St. Petersburg, and this was adapted to experiments with man by Likhachev. Both calorimeters were so arranged that the respiratory quotient of the subject could be studied for short periods—and, in fact, most of the calorimetric experiments on animals have been accompanied by respiration experiments of some sort. These were sometimes made separately, were often quite crude, and frequently covered only short periods, so that the total respiratory products were not determined. In most cases the object, primarily, was the study of the heat rather than the respiratory products.

An instrument which combined the respiration apparatus and the calorimeter—that is, a respiration calorimeter—was devised by Rubner about 1890. It permitted the determination of the respiratory products and the heat simultaneously in the same chamber, and was suitable for experiments with small animals. The respiration apparatus was of the Pettenkofer and Voit type. The calorimeter was composed of jackets of air and of water surrounding the respiration chamber, the heat given off being measured by the expansion of the air in this jacket (as in an air thermometer) and by the rise in temperature of the water jacket.

In 1893 Rosenthal described a respiration calorimeter, also for small animals, in which the principle of the Regnault and Reiset respiration apparatus was employed.

The highest development in this direction which has yet been reached is the respiration calorimeter elaborated by Professors Atwater and Rosa in this country, which is adapted to experiments with man. This is a modification of the Pettenkofer respiration apparatus, with original devices for the accurate determination of the water and the heat eliminated by the subject. The measurement of water is facilitated by passing the air through a freezing mixture as it enters and leaves the respiration chamber, which freezes the most of the water out of it. This water is collected in copper cylinders, which can be removed and weighed, and the residual moisture in the air current is absorbed in tubes of sulphuric acid.

The respiration chamber, which is likewise the calorimeter chamber, is provided with double metal walls, surrounded by a wooden jacket with air spaces. Advantage is taken of the fact that if the two metal walls are kept at the same temperature there will be no radiation of heat through the walls, and there is a delicate arrangement for maintaining this condition. The current of air is kept at the same temperature as it enters and leaves the respiration chamber. All the heat generated in the chamber is taken up in so-called absorbers by a current of cold water passing through them.

Many of the mechanical devices which contribute materially to the success of the apparatus are due to the ingenuity of the mechanician, Mr. O. S. Blakeslee. This is true of the meter pump—a marked improvement over the aspirators formerly used—which performs the threefold office of drawing the air current through the respiration chamber, measuring and recording its amount automatically, and delivering an aliquot portion for analysis.

Considered as an instrument of precision, this respiration calorimeter is very satisfactory. It is possible to measure with it the large amounts of water and carbon dioxid given off by a subject during long periods as accurately as these factors are ordinarily determined in the laboratory analysis of organic compounds. The measurement of heat is equally accurate, showing 99 per cent or more of the theoretical amount.

The Atwater-Rosa apparatus is to be adapted to use with animals, which will necessitate some devices for supplying food and collecting the urine and feces. The first step in this direction has been taken by the Pennsylvania Experiment Station in cooperation with the Bureau of Animal Industry of this Department. An apparatus suitable for experiments with cattle is being constructed, under the direction of Prof. H. P. Armsby, which will involve some minor modifications of the Atwater-Rosa apparatus.

It is interesting to note also that funds for the construction of respiration calorimeters of the Atwater-Rosa type have recently been appropriated by the Prussian and the Austro-Hungarian governments. Both will be adapted to experiments with cattle or other large animals. The Prussian Government has appropriated $6,000 for such an apparatus, to be built under the direction of Prof. Oscar Hagemann at the Physiological Institute of Poppelsdorf, near Bonn. The apparatus provided for by the Austro-Hungarian Government will be located in the new Physiological Institute at Budapest, under the direction of Professor Tangl. Both of these gentlemen are planning to come to this country soon for the purpose of studying the apparatus and its operation, and will have parts of the apparatus made here.

Naturally, an apparatus so expensive in construction and operation can be maintained by only a few of our experiment stations. It is a matter for congratulation that the apparatus has been brought up to so high a state of perfection, and that its use is not to be confined to experiments with man. Already it has been employed to demonstrate experimentally the application of the law of conservation of energy in the body. It is adapted to the study of a wide range of problems connected with the principles of nutrition, in a much more thorough and conclusive manner than has hitherto been possible. In experiments with animals, for example, such problems as the comparative value of different foods and rations for maintenance and the production of energy, the value of different rations for the production of body fat and milk fat, and the possibility of inducing gains in nitrogenous tissue in the body by any system of feeding may be investigated. Further, it will, it is believed, be possible to measure the amount of energy required to chew and digest different kinds of foods, and thus to learn their real nutritive values.

RECENT WORK IN AGRICULTURAL SCIENCE.

CHEMISTRY.

Proceedings of the twelfth and thirteenth conventions of the Association of Agricultural Experiment Stations in the German Empire (*Landw. Vers. Stat., 52 (1899), No. 1–2, pp. 1–136, pls. 3*).—The twelfth convention was held at Münster September 17, 1898, the thirteenth (extra) at Berlin October 30, 1898. The subjects considered included the determination of the citrate solubility of phosphoric acid in Thomas slag, the sifting of Thomas slag for analysis, the various forms of phosphoric acid in soils and their determination, the permissible amount of perchlorate in nitrate of soda, the determination of the "freshness" of feeding stuffs, the valuation of molasses feed, means of encouraging more accurate cooperative experiments with fertilizers, the participation of the German stations in the international exposition at Paris in 1900, and miscellaneous topics.

The direct precipitation method of determining citrate-soluble phosphoric acid in Thomas slag (E. S. R., 9, p. 1022) was adopted as official. The recommendation of the section on fertilizers, that ground Thomas slag be sifted through a 2 mm. mesh sieve and the fine meal analyzed, the results being calculated to the original meal, was accepted.

Numerous comparative tests of P. Wagner's new method for determining assimilable phosphoric acid in slag (treatment with 2 per cent instead of 1.4 per cent citric acid) were reported. There was very satisfactory agreement between the results of different analysts, the average being slightly higher than that obtained by the old method. Wagner claims, on the basis of pot experiments, that the new method gives results more nearly identical with actual availability to plants than the old method. The method was adopted, to go into effect November 1, 1898.

A paper containing a general discussion of the forms of phosphoric acid in the soil and their determination was read by O. Emmerling, and the subject was discussed by others.

The association adopted the proposition to determine perchlorates and chlorates together in nitrate of soda, using the Gilbert oven and omitting the use of manganese peroxid. M. Maercker called attention to the fact that 1½ per cent of perchlorate may prove injurious in case of rye, and suggested further study of the allowable amount of perchlorate in nitrate.

The question of the determination of the "freshness" of feeding stuffs was presented by O. Emmerling and discussed by others. The matter was referred back for further study. The same action was taken regarding the question of valuation of molasses feed. It was agreed that in stating the analysis of molasses feeds the total nitrogen multiplied by 6.25 should be designated "nitrogenous matter derived from molasses and similar food materials."

Certain minor changes and corrections were made in the rules for seed testing.

The discussion of means of securing more accurate cooperative experiments with fertilizers was led by T. Pfeiffer, who recommended a system of prizes. No action was taken on this proposition.

The utilization of the space granted the association at the Paris Exhibition was discussed and 10 groups of exhibits were decided upon as follows: (1) Animal physiology (Möckern and Poppelsdorf stations), (2) dairying (Kiel, Kleinhof-Tapiau, Hameln), (3) fermentation industries and starch manufacture (Berlin), (4) soil investigations (Rostock, Kiel), (5) moor culture (Bremen), (6) fertilizer control (Halle, Bonn, Münster), (7) feeding stuffs control (Bonn, Kiel), (8) seed control (Tharand, Hamburg), (9) plant protection (Halle), and (10) vegetation experiments (Bernburg).

Various tests for calcareous fertilizing materials proposed by B. Tacke were accepted by the association.

It was agreed to determine ammonia in fertilizers guaranteed to contain nitrogen in this form by distilling an aliquot of a solution obtained by shaking 20 gm. of the substance in 1 liter of water with magnesia.

J. König presented a report on the conditions and needs of the stations, in which he asserted that the work of the German stations suffers from an excessive amount of control work, from lack of efficient assistants and of cooperation of the various agencies having the same or similar aims, and from the practice of publishing the results of investigations only in annual reports, thus causing much delay in the publication of important investigations.

A new apparatus for preparing ash of plants for analysis, G. M. TUCKER (*Ber. Deut. Chem. Gesell., 32 (1899), No. 14, pp. 2583–2585, figs. 2; abs. in Chem. Ztg., 23 (1899), No. 92, Repert., p. 329, fig. 1*).—This apparatus is similar in principle to that of Shuttleworth (E. S. R., 11, p. 304), but air is drawn instead of forced through the apparatus, the gases evolved being passed through a wash bottle to prevent loss. The apparatus is of platinum, and rather simpler in construction than Shuttleworth's. It is small at the bottom, with sloping sides, and has a tight-fitting cover with two openings, the air tube in the center extending to the bottom and carrying the stirrer, and the outlet at one side carrying a platinum tube. The outlet has a trap to prevent particles being carried over mechanically. The platinum tube connects by a glass tube with a wash bottle, an aspirator being connected with the other opening of the bottle.

The crucible is first heated in a conical sand bath and later over the naked flame, being placed in a ring cut from asbestos for the latter heating.

Determination of the total phosphoric acid in Thomas slag, C. ASCHMAN (*Chem. Ztg., 23 (1899), No. 41, pp. 435, 436*).—In the method proposed 5 gm. of the slag is placed in a 500 cc. flask, which is filled to the mark with nitro-sulphuric acid (420 gm. of pure nitric acid, 1.2 sp. gr., and 50 gm. of concentrated sulphuric acid in 10 liters of water). The flask is rotated for ½ hour in an apparatus making 40 to 45 revolutions per minute. The solution is filtered and allowed to stand 12 hours, or overnight, thus getting rid of the greater part of the calcium sulphate. To 50 cc. of the solution 10 cc. of citric acid solution (500 gm. of citric acid per liter of water) is added. The solution is then made slightly alkaline with ammonia, and 50 cc. of water added. When the solution has cooled and become perfectly clear the phosphoric acid is precipitated with 20 cc. of magnesia mixture (Wagner's), stirring for ½ hour. The precipitation is considered complete at the end of from 1 to 2 hours. Longer standing does no harm.

Estimation of the lime, potash, and phosphoric acid in Hawaiian soils probably available for the immediate crop, W. MAXWELL (*Jour. Amer. Chem. Soc., 21 (1899), No. 5, pp. 415–417*).—In investigations on Hawaiian soils (E. S. R., 10, p. 527) it was found that "aspartic acid dissolves phosphoric acid, lime, potash, and other bases (iron and alumina) out of the soil in almost the exact proportions that these elements have been found in the 'waters of discharge,' and in which they are being removed by 'cropping.'" The method of procedure recommended is as follows:

"Two hundred grams of whole soil (not fine earth), air-dried, is put into a glass-stoppered Winchester quart bottle; to this soil is added 1,000 cc. of distilled water containing 10 gm. of pure aspartic acid, thus making a 1 per cent solution. The bottle is gently shaken every 15 minutes during the day portion of 24 hours (from 8 o'clock a. m. to 5 o'clock p. m.). By 'gently shaken' is meant that the bottle is taken up, and shaken in circular movement until the soil at the bottom is totally and thoroughly moved, but without ever rising above the surface of the solution, thus avoiding a remnant of the soil attaching to the sides of the bottle above the solution surface. . . . At the end of 24 hours the contents of the bottle are emptied upon a filter, when 750 cc. of the clear filtrate is taken for analysis. The 750 cc. of filtrate is evaporated to dryness, and the residue gently ignited to remove all organic matter. The mineral residue is moistened with hydrochloric acid, evaporated and dried; then again softened with the same acid, warmed, and taken up with water, and filtered. After removal of iron and alumina from the filtrate with ammonia, the lime and potash are estimated in the usual way. The ammonia precipitate, containing also the iron and alumina, is dissolved in a little hydrochloric acid, neutralized with ammonia, the solution cleared with a little nitric acid, after which the phosphoric acid is precipitated and estimated by the common practice. . . .

"As a 1 per cent solution of aspartic acid takes out of Hawaiian soils in 24 hours the same amounts of lime, potash, and phosphoric acid that are removed during the production of 10 crops of cane, therefore one-tenth of these amounts may be taken as a nearest approach to the proportions of lime, potash, and phosphoric acid that are available for the immediate crop."

Contribution to the determination of the available phosphoric acid in soils under cultivation, C. A. GOESSMANN, H. D. HASKINS, and C. I. GOESSMANN (*Massachusetts Hatch Sta. Rpt. 1898, pp. 127–134*).—Samples of soil from plats which had been used for a number of years for comparative tests of phosphates (E. S. R., 9, p. 337) were examined by 3 different methods for available phosphoric acid: (1) The official fifth-normal hydrochloric-acid method, (2) Dyer's 1 per cent citric acid method, and (3) a neutral ammonium-citrate method, which is thus described:

Digest 10 gm. of the soil for ½ hour at 65° C., with 500 cc. of strictly neutral solution of citrate of ammonia, specific gravity 1.09, in a rubber-stoppered flask, shaking thoroughly every 5 minutes. At the expiration of 30 minutes remove flask from bath and filter as rapidly as possible. Wash thoroughly with water at 65° C. Evaporate the solution to dryness, char, and abstract with dilute nitric acid. Filter and wash thoroughly with water. Burn the residue to a white ash, add it to the solution and bring to complete dryness on sand bath. Take up with hot water and a few cc. of nitric acid. Digest for ½ hour. Filter and wash thoroughly and determine the phosphoric acid in the solution in the usual way.

The results obtained were as follows:

Available phosphoric acid in soils by different methods.

No. of sample.	Moisture.	Total phosphoric acid.	Available phosphoric acid. By fifth-normal hydrochloric acid.	Available phosphoric acid. By 1 per cent citric acid.	Available phosphoric acid. By neutral ammonium citrate.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
1	0.77	0.255	0.0285	0.01825	0 0735
2	.87	.290	.0338	.01650	.0945
3	.95	.210	.0407	.01420	.0865
4	1.07	.220	.0330	.01920	.0925
5	1.02	.180	.0345	.01430	.1070

The results varied with the different methods and did not correspond with the yields obtained on the plats.

Method of analysis of citric acid extracts of soils, J. EGOROV (*Izv. Moscow Selsk. Khoz. Inst., 5 (1899), No. 1, pp. 88–90; abs. in Bul. Soc. Chim. Paris, 3. ser., 22 (1899), No. 13, p. 687*).—For analysis of these extracts the author proposes the following method: Add fuming nitric acid and not more than 0.2 gm. of manganic oxid (Mn_3O_4) to the extract and heat gently over the naked flame until oxidation is complete.

Two simple and rapid methods of determining carbon dioxid in caustic lime, limestone, etc., and especially in soils, V. SCHENKE (*Chem. Ztg., 23 (1899), No. 59, pp. 612–614, fig. 1.*)—The author employs, with slight modifications and in an apparatus of modified form, the well-known method of decomposing the carbonates by an acid and determining the carbon dioxid by the loss of weight. He uses hydrochloric instead of sulphuric acid, and calcium chlorid for drying instead of sulphuric acid.

The author claims to have worked out a simple and effective method of determining the lime and magnesia in soils by the amount of carbon dioxid they are capable of taking up. These bases in the soil are combined in the main with carbon dioxid or with humus acids, and when the soil is ignited these compounds are decomposed, the caustic bases being left behind. Five grams of the soil is ignited over a blast lamp for about 10 minutes in a platinum dish, cooled in a desiccator, and weighed quickly. The residue is then treated with a saturated solution of ammonium carbonate, dried and heated again to about 150° to drive off the excess of ammonium carbonate, again cooled and rapidly weighed. The increase in weight is due to the carbon dioxid which has combined with the lime and magnesia, and from this the amount of these constituents in the soil can readily be calculated. It is claimed that other bases in the soil are not affected by this treatment in a way that will vitiate the results.—J. T. ANDERSON.

Determination of reducing sugars in musts and wines, PELLET (*Rev. Chim. Analyt. et Appl., 4* (*1899*), *No. 8, pp. 253–256*).—A study of the influences of neutral and subacetate of lead upon the polarization process, and the action of Fehling's solution. Among the results presented are the following: (1) Direct polarization of must at 22 to 23°, —37.8°; (2) with 10 parts per 100 of neutral lead acetate, (30 per cent), —37.4°; (3) with 10 parts per 100 of subacetate of lead, 30 Baumé, in neutralized must, —38.4°; (4) with 10 parts per 100 of neutral lead acetate, —37.4°; (5) with 10 parts per 100 of subacetate of lead, —39.4°. After inversion according to Clerget No. 2 showed —42.35° and No. 3 —42.35°. By the use of Fehling's solution the following results were obtained: No. 1, must, direct, 18.7 per cent; No. 4, with the neutral acetate, 18.5; No. 5, with subacetate of lead, 18.4; and No 2, after inversion, 18.5. Ten cubic centimeters of Fehling's solution was found to correspond to 0.052 gm. levulose and to 0.048 gm. dextrose; for ordinary determinations the Fehling solution may be considered as corresponding to equal parts of levulose and dextrose, but when the sugar percentages amount to 60 to 70 per cent a sensible error is introduced.—H. SNYDER.

Report of the chemist, C. A. GOESSMANN (*Massachusetts Hatch Sta. Rpt. 1898, pp. 105–141*).—This includes a brief review of the work of inspection of fertilizers in 1898 (see p. 528), miscellaneous chemical analyses, notes on wood ashes (see p. 527) and on fertilizers for pot and greenhouse plants (see p. 528), an account of tests of the availability of the nitrogen in dried blood and leather refuse in the presence of acid and alkaline phosphates (see p. 526), investigations on the availability of the phosphoric acid in cultivated soils (see p. 508), and analyses of drainage waters (see p. 525).

Laboratory work in physiological chemistry, F. G. NOVY (*Ann Arbor: G. W., 1898, pp. 326, pl. 1, figs. 24*).—A laboratory manual.

Methods of analysis adopted by the Association of Official Agricultural Chemists, November 11, 12, and 14, 1898, H. W. WILEY (*U. S. Dept. Agr., Division of Chemistry Bul. 46, rev. ed., pp. 86, figs. 4*).—The methods of the association are given in full, revised to include changes adopted at the Washington meeting in 1898.

Micro-chemical analysis, M. E. POZZI-ESCOTT (*Rev. Chim. Analyt. et Appl., 4* (*1899*), *No. 9, pp. 303–306*).—A short discussion of the importance of micro-chemistry, and a brief mention of the contributions of some of the investigators who have worked along this line. The accuracy of the methods employed, and their application to the study of precipitates, and to the study of complex chemical reactions are considered.—H. SNYDER.

Electrolytic determinations and separations, L. G. KOLLOCK (*Jour. Amer. Chem. Soc., 21 (1899), No. 10, pp. 911–928*).—Some of the earlier methods are reviewed, and the conditions of current density, amperage, voltage, and other factors fully worked out.—L. H. MERRILL.

Preservation of Hubl's reagent, R. BOLLING (*Amer. Chem. Jour., 22 (1899), No. 3, pp. 213, 214*).—An investigation as to the loss of strength under varying conditions demonstrated the fact that the loss was very rapid and was but little retarded by the use of absolute alcohol or by the exclusion of light and air.—E. B. HOLLAND.

The analysis of golden sirup, R. BODMAN, N. LEONARD, and H. M. SMITH (*Analyst, 24 (1899), No. 283, pp. 253–257*).—A report on the examination of 26 samples of sirup by optical and gravimetric methods and the interpretation of the results.—E. B. HOLLAND.

The determination of the fat content of milk, R. WINDISCH (*Landw. Vers. Stat., 52 (1899), No. 3, pp. 209–211*).—The author describes the method of Liebermann and Székely (E. S. R., 4, p. 776), and gives the results of a comparison between it and the Gerber rapid method on 14 samples of milk. The results by the 2 methods compared well, rarely showing over 0.05 per cent difference.

Determining the amount of boracic acid [in butter], VADAM (*Jour. Pharm. et Chim., 6. ser., 8 (1899), No. 3, pp. 109–111*).

Progress in the examination of spices and their adulterations, T. F. HANAUSEK (*Chem. Ztg., 23 (1899), No. 44, pp. 463–466*).—A review of recent literature.

Analytical methods for distinguishing between nitrogen of proteids and nitrogen of simpler amids or amido acids, J. W. MALLET (*Chem. News, 80 (1899), Nos. 2080, pp. 168–171; 2081, pp. 179–182*).—See E. S. R., 10, p. 819.

The coagulation of albumin, C. HALPHEN (*Jour. Pharm. et Chim., 6. ser., 8 (1899), No. 4, pp. 173–175*).—The use of citrate of ammonia in estimating albumin is pointed out.

The color reactions of sesame oil, and three new characteristic reactions, M. J. BELLIER (*Rev. Chim. Analyt. et Appl., 4 (1899), No. 7, pp. 217–220*).—The following reactions are discussed: (1) Behrens' (equal parts of sulphuric and nitric acid), (2) Bishop's (hydrochloric acid), (3) Baudouin (hydrochloric acid 1.18 sp. gr.), (4) Villavecchia and Fabris' (hydrochloric acid, containing a small quantity of furfurol), (5) Tocher's (hydrochloric acid 14 cc., pyrogallic acid 1 gm.), and (6) Cavalli's (60 per cent hydrochloric acid, 40 per cent nitric acid). Tocher's reaction is considered as worthy of the most confidence. The new reactions reported are with (1) ammonium vanadate, (2) formaldehyde, and (3) resorcin.—H. SNYDER.

A characteristic color reaction of tartaric acid, M. J. WOLFF (*Rev. Chim. Analyt. et Appl., 4 (1899), No. 8, p. 263*).—Sulphuric acid and resorcin produce an intense coloration, which disappears upon dilution with water. Neither oxalic nor citric acid gives this reaction under similar conditions.—H. SNYDER.

Water and sewage examination results (*Chem. News, 80 (1899), No. 2080, pp. 161, 162*).—This is the report of the committee appointed to establish a uniform system of recording the results of the chemical and bacteriological examination of water and sewage, read before the British Association for the Advancement of Science at its Dover meeting in 1899.

Fractional precipitation of peptic digestion products by means of zinc sulphate, E. ZUNZ (*Ztschr. Physiol. Chem., 27 (1899), No. 3, pp. 219–249*).

The preparation of lecithin and other myelin bodies from egg yolk and brain extracts, G. ZUELZER (*Ztschr. Physiol. Chem., 27 (1899), No. 3, pp. 255–266*).

Gossypol, a constituent of cotton seed, L. MARCHLEWSKI (*Jour. Prakt. Chem., 60 (1899), pp. 84–90; abs. in Chem. Ztg., 23 (1899), No. 64, Repert., p. 232*).—This name is applied to a phenol-like body extracted from raw cotton seed by sodium hydrate and precipitated in an impure state by acids. The properties of the purified substance are described.

On isomaltose, Pottevin (*Ann. Inst. Pasteur, 13 (1899), No. 10, pp. 796–800*).

Protein compounds of arginin, U. Susuki (*Chem. Ztg., 23 (1899), No. 64, p. 658*).

The coloring matter of cotton flowers; note on rottlerin, A. G. Perkins (*Jour. Chem. Soc. [London], 75 (1899), No. 441, pp. 825–829*).

Action of formaldehyde on enzyms and on certain proteids, C. L. Bliss and F. G. Novy (*Jour. Expt. Med., 4 (1899), pp. 47–80; abs. in Tech. Quart., 12 (1899), No. 2, Rev. Chem., pp. 55, 56*).

Cause of blackening of bean pods, Bourquelot and Hérissey (*Jour. Pharm. et Chem., 6. ser., 7 (1898), p. 385; abs. in Amer. Jour. Pharm., 71 (1899), No. 6, p. 281*).—A chemical study.

The index of refraction of a number of species of starch, Emma Ott (*Oesterr. Bot. Ztschr., 49 (1899), No. 9, pp. 313–317, fig. 1*).

A new method for measuring temperatures, D. Berthelot (*Bul. Mus. Hist. Nat. [Paris], 1898, No. 6, pp. 301–304*).

Liquid air and the liquefaction of gases—theory, history, biography, practical applications, manufacture, T. O'C. Sloane (*New York: Norman W. Henley & Co., 1899, pp. 365, pls. 9, figs. 71*).

Continuous extractors for volatile solvents, E. Van Melckebeke (*Bul. Assoc. Belge Chim., 13 (1899), No. 5, pp. 242–245; abs. in Jour. Soc. Chem. Ind., 18 (1899), No. 9, p. 863, figs. 3*).

A new automatic burette, E. Lallemant (*Bul. Assoc. Chim., 17 (1899), No. 2, pp. 149, 150, fig. 1*).

Platinum apparatus for ash determination (*German Patent No. 105058; Chem. Ztg., 23 (1899), No. 87, p. 943, fig. 1*).—A description of Shuttleworth's apparatus which has been patented by the maker, W. C. Heraeus.

Relative efficiency and usefulness of various forms of still heads for fractional distillation, with a description of some new forms possessing special advantages, S. Young (*Trans. Chem. Soc. [London], 1899, pp. 679–710; abs. in Jour. Soc. Chem. Ind., 18 (1899), No. 9, pp. 859–863, figs. 5*).

BOTANY.

The resumption of root growth in spring, E. S. Goff (*Wisconsin Sta. Rpt. 1898, pp. 220–228, figs. 6*).—To ascertain the bearing of early spring root growth of perennial plants upon the operations of transplanting and early cultivation, the author conducted a series of observations upon the root growth of several species of trees and other plants in the spring of 1898. The observations were made by excavating a short ditch near the point where the main roots were supposed to terminate, and washing out by means of a gentle stream of water the roots and root branches to their tips. The experiment developed some rather important points which, if not new to science, have been but little applied in plant culture.

As a result of numerous observations, the conclusion was reached that in many plants root growth starts before stem growth. This was found true in the case of Norway, white, Douglas, and Colorado blue spruce, American arbor vitæ, Scotch pine, hemlock, spruce, tamarisk, sugar maple, apple, pear, morello cherry, chokecherry, white birch, Russian mulberry, Russian olive, red currant, white currant, and gooseberry. In the case of the red currant the root development was found to be far in advance of bud development. Some herbaceous plants were noted as starting root growth extremely early in the spring. On March 22 roots of strawberry and quack grass appeared to have made considerable growth, but there was at this time no visible growth of plants above ground. On a few plants the root growth apparently did not begin earlier than bud growth. This was found true in the case of a vine of Worden grape and possibly others.

Observations made on plants representing a number of botanical species, showed that root growth was most vigorous at the apex of the main roots, next to this it is most vigorous at the apex of the principal branches, and the earliness and vigor of starting diminishes as we recede from the growing points of the principal roots. This gradational growth was well shown in measurements from a root of a seedling of the Early Richmond cherry washed out on April 28. This root terminated in two very thick shoots, each of which at this time had made 2 in. of new growth. At the base of these two shoots were five smaller shoots, the combined length of which was 2¾ in. Thus the total new growth at and just behind the apex amounted to 6¾ in. The next branch of any considerable size had grown 1¼ in., the next a little less than 1 in., the next ½ in., and the next two but ¼ in. each. Farther back than this very little growth had taken place. The vigorous resumption of growth in the apical portion of the root apparently starves many of the older branchlets, for the number of these rapidly diminishes as we follow back the main roots toward the trunk. The early and vigorous terminal growth of roots would seem to have an important bearing upon the time that trees and other perennial plants should be lifted for transplanting. The most favorable time for lifting such plants is probably in autumn or very early in spring. If replanting can not be performed at once, the roots may be temporarily planted or heeled in in soil, sand, sawdust, or other well aerated and moist medium. In this way the root growth which starts will have a better chance of being saved than if the tree be lifted immediately before planting.

As the surface of the soil is first warmed in the spring, naturally root growth would be most active in this layer of soil, and the parts of the soil from which roots are in a measure excluded during the dry weather of summer may serve as a feeding ground in early spring. This was strikingly shown in the case of the currant when an inch of the surface soil from an area of about 4 sq. ft. having been washed away, revealed a multitude of delicate rootlets. This very shallow depth of early root growth would seem to offer an objection to the early cultivation of currants and gooseberries and other plants that commence growth especially early.

It has been repeatedly stated in horticultural publications that the fibrous roots of perennial plants die in autumn and are renewed on the resumption of growth in the spring. The author investigated this subject on the plants already named above and in addition about 15 other species, and failed to find any evidence of the general death of finer roots. On the contrary the new growth generally starts from the identical tips where it ceased in autumn. The erroneous idea of general death of root tips may probably have come from superficial observation, since in many plants examined the rootlets appeared dead to the naked eye, but on closer examination it was evident that only the outer bark layer was really dead, and beneath this the tissues were usually plump and in good condition.

In conclusion the author states that "no evidence was brought out to warrant the conclusion that the finer roots of plants may be wisely ignored in transplanting. It is undoubtedly true that these roots are usually short-lived under adverse treatment, but this fact should emphasize the importance of so handling the plant as to preserve the finer roots rather than to be construed as a license for their wholesale destruction. . . . The nearer we can approach in transplanting to the methods practiced in shifting plants, the more highly will the transplanting art have been developed."

The relation between the green coloration of leaves and their chlorophyll assimilation, E. Griffon (*Compt. Rend. Acad. Sci. Paris, 128 (1899), No. 4, pp. 253–256*).—The author has sought to ascertain whether any relationship exists between the intensity of the color of leaves and the degree with which they decompose carbon dioxid, and whether it would be possible in all cases to explain the differences in assimilation by difference in structure of leaves and the quantity of chlorophyll.

Experiments were conducted with varieties or nearly related species of cereals, lettuce, fuchsias, begonias, grapes, roses, privets, cannas, chrysanthemums, spirea, peaches, and plums whose foliage exhibited marked variations. With a number of these the intensity of assimilation semed to be in almost direct proportion to the intensity of their green color, while in others almost diametrically opposed results were obtained. In some cases the thickness and structure of the mesophyll, development of palisade tissue, and the number, size, and color of the chromoleucites in each cell seemed to be influencing factors in the variation of carbon assimilation, but there are evidently other causes for the variation in carbon dioxid assimilation, such perhaps as the specific activity of the chromoleucites or differences in the nature of the chlorophyll.

The rôle of sodium in plants, Stahl-Schröder (*Ann. Agron., 25 (1899), No. 6, pp. 294–297*).—Experiments are reported with oats, carrots, and buckwheat, from which it appears that these plants can absorb relatively large amounts of sodium without inconvenience to growth. The phosphate, and especially the nitrate of sodium, are absorbed directly by the plant. When the soil is rich in potash, sodium is not taken up by the plant in any considerable quantity except as the acid is needed by the plant. The decomposition of sodium salts takes place principally in the roots, although a small quantity is decomposed in the stem and leaves and still less in the seed.

Investigations were conducted to ascertain whether sodium can replace potassium in the economy of the plant, and the author concludes that it can not, the yield in every case being proportional to the amount of potassium in the soil or added as a fertilizer. He attributes to sodium an indirect action in influencing a larger assimilation of potassium.

Soils for artificial cultures, R. WARINGTON (*Nature, 59 (1899), No. 1527, p. 324*).—The author states that it is often assumed in artificial cultures that a pure quartz sand watered with solutions supplying phosphates, sulphates, and chlorids of potassium, magnesium, and iron is a fit and proper soil, and that any deficiency of luxuriance in plants grown in such a medium is due to some special circumstance unconnected with the general conditions of the experiment. He claims that such a soil is in several respects a very unnatural medium for plant growth and is generally unsuited for the purposes of investigation. The salts in question if applied to an ordinary arable soil would undoubtedly supply the ash constituents required by the plant, but in this case they would reach the plant in an entirely different form from that which occurs in the case of an artificial soil of quartz sand. In natural soils containing calcium carbonate, hydrate silicates, and hydrate ferric oxid, all the alkali salts are decomposed, their acids combined with the lime of the soil and their bases held in feeble combination on the surface of moist silicates and ferric oxid, from which they are easily extracted by the acid sap of the root hairs. In a naturally fertile soil the alkalis are supplied to the plants as bases and the soil water itself always contains a quantity of calcium carbonate dissolved in carbonic acid. That a plant requires a supply of bases is shown by the character of the plant ash. The ashes of leaves and stems are always of an alkaline character.

The immense improvement in the luxuriance of an artificial culture in sand has been observed when nitrates are added to the nutritive salts employed, but it is not to be entirely attributed to the supply of nitrogen given. The nitrate in this case is the only salt which can supply the plant with a base and its addition to the soil greatly improves the general conditions of growth. The nitrate acts in this manner because the nitric acid is employed in the plant for the production of nitrogenous organic matter and its base at once becomes available for combination with organic acids.

The author states that for most purposes any fertile sandy soil may be employed for artificial cultures, and it can be as thoroughly sterilized if sufficient care be taken, but if its special chemical properties are to be retained it should not be dried or burned. If an artificial soil is needed, quartz sand should in every case be mixed with from 2 to 5 per cent of calcium carbonate. Powdered feldspar is an excellent addition to an artificial soil. In the case of an artificial soil the sand should be fine in order to have a sufficient power of holding water, and if the conditions of the experiment do not forbid it, some humic material should be supplied. The addition of 1 per cent of moss litter to this soil is said to be more advantageous. Since the water of natural soils always contains carbonic acid, this point should not be forgotten, especially when no addition of humic material is made.

The effect of Nitragin and inoculation soil on yellow lupines, ADLER (*Ber. Landw. Versstat. Jena, 1898, pp. 19, 20*).—Zinc pots were filled with sandy soil, poor in lime and well fertilized with potash and phosphatic acid fertilizers. Yellow lupines were sown in all the pots. Five pots received no further treatment, 5 were inoculated with Nitragin, and 5 were inoculated with soil on which lupines had grown. All pots were cared for in like manner. The grain yield was increased 34.44 per cent by the use of Nitragin and 106.51 per cent by the use of inoculated soil, and the hay yield 12.17 per cent by the use of Nitragin and 42.86 per cent by the use of the inoculated soil.

North American slime molds, T. H. MACBRIDE (*New York: The Macmillan Co., 1899, pp. XVII + 233, pls. 18*).—In this work, which is an outgrowth of the author's monograph on the Myxomycetes of eastern Iowa, all the species are for the first time brought together in English.

The arrangement of the larger divisions is essentially that of Rostafinski, modified by the author to include some recent ideas relative to the sequence of species.

In the introduction the author discusses the much-contested position of the slime molds, and suggests that they are possibly independent, with a somewhat nearer kinship to plants than to the animal kingdom. There are said to be 44 genera and about 212 species. Of this number 19 genera are monotypic. All species except 4 or 5 are said to be saprophytic, and of the parasitic ones the only one of economic importance is that causing the club root of crucifers, *Plasmodiophora brassicæ*.

The influence of atmospheric and soil constituents on the anatomical structure of plants, W. MEYER (*Bot. Centbl., 79 (1899), No. 11-12, pp. 337-350*).—A study is given of a large number of alpine plants to show the effect of weather and soils on their structure.

Influence of temperature on respiration, W. PALLADIN (*Warsaw, 1899; abs. in Bot. Centbl., 80 (1899), No. 1, pp. 18, 19*).

Caoutchouc, or India rubber (*Roy. Bot. Gard. Ceylon Circ. 1899, No. 12-14, pp. 105-168, figs. 4*).—Gives notes on the origin and methods of collection, preparation for market, etc.

The diameter increment of the wood of coniferous trees in relation to climatic conditions, R. TURNBULL (*Trans. and Proc. Bot. Soc. Edinburgh, 21 (1898), pt. 2, pp. 94-104, pl. 1*).—An attempt is made to find some relationship between the annual diameter increment and the climatic and meteorological conditions. The observations were on larch, Scotch pine, and Norway spruce.

Frost formations in trees, R. KOPEZKY (*Centbl. Gesam. Forstw. Wien, 25 (1899), No. 10, pp. 426-431, figs. 3*).—The character of frost injuries to trees is discussed.

On the poisonous quality of Boletus luridus, G. ARCANGELI (*Atti Soc. Toscana Sci. Nat, 11 (1899), pp. 139-142*).

A new species of Oöspora which causes efflorescence on cigars and in fermenting tobacco, A. SPLENDORE (*Riv. Tec. e Amministr. Rome, 1899, pp. 27, pl. 1; abs. in Hedwigia, 38 (1899), No. 5, Repert., p. 221*).—A description is given of *Oöspora nicotianæ* which causes an efflorescence on fermented tobacco. Notes are given on the effect of temperature on the development of the fungus and means are suggested for preventing its appearance.

On the biology of some wood-frequenting fungi, F. CZAPEK (*Ber. Deut. Bot. Gesell., 17 (1899), No. 5, pp. 166–170.*)

Studies on the parasitism of Agaricus melleus, G. WAGNER (*Ztschr. Pflanzenkrank., 9 (1899), No. 2, pp. 80–88*).—The author reports 32 host plants for this fungus and gives results of a number of experiments to infest other trees with it. Additional host plants for *Agaricus ostreatus* and notes on *Plasmopara viticola* and *A. mucidus* are given.

Conidia formation in certain fungi, C. WERNER (*Inaug. Diss., Frankfurt, 1898, pp. 48, figs. 55; abs. in Bot. Centbl., 80 (1899), No. 4, pp. 129, 130*).—The conditions under which conidia are formed by *Nectria cinnabarina* and *Volutella ciliata* are discussed and the different forms of conidia described.

The effect of removing the flowers on the assimilation of nitrogen by leguminous plants, M. SOAVE (*Staz. Sper. Agr. Ital., 32 (1899), No. 5, pp. 499–516*).—Experiments are quoted with *Vicia faba, Phaseolus multiflorus, Pisum sativum*, and *Lupinus albus*, in which duplicate lots of plants were grown under similar conditions except one lot flowered and the other had the flowers constantly removed. In the case of the Vicia there was a decided gain in dry weight and nitrogen content where the flowers were removed. In the other examples there was either a loss in dry weight or nitrogen content or both. Root tubercle development was good in every case.

Nitragin, a germ fertilizer, W. P. BROOKS (*Massachusetts Hatch Sta. Rpt. 1898, pp. 63–65*).—A brief description is given of this material and a plan of experiments in which it was tested is outlined. In these tests with the field pea and alfalfa a slightly better crop was given where the Nitragin was used in combination with mineral fertilizers than where the fertilizers were used without. The experiments thus far conducted seem to indicate some slight benefit following the use of this germ fertilizer.

The fixation of nitrogen by algæ (*Pharm. Jour., 4. ser., 1899, No. 1498, p. 241*).—A brief note on Bouilhac's work.

Sugar as an agent in nitrogen fixation and an aid to the growth of plants, J. GOLDING (*Jour. Soc. Chem. Ind., 18 (1899), pp. 564–566; abs. in Jour. Chem. Soc. [London], 76 (1899), No. 444, II, p. 689*).—In case of alfalfa and beans grown in sterilized sand inoculated with nodule bacteria the addition of sugar increased the yield, a fact attributed to the increased activity of the nitrogen-fixing bacteria due to the sugar.

Experiments on the staining of cell walls, J. CHALON (*Bul. Roy. Soc. Bot. Belg., 37 (1898), No. 2, pp. 59–90*).

METEOROLOGY—CLIMATOLOGY.

Investigations on periodicity in the weather, H. H. CLAYTON (*Proc. Amer. Acad. Arts and Sci., 34 (1899), No. 22, pp. 599–618, charts 13*).—This is an account of a continuation of previous studies by the author along the same line (E. S. R., 6, p. 698; 7, p. 930), and includes a summary of studies by the author and by European meteorologists (Van Bebber, Ekholm, Arrhenius, Howard, and others), on the influence of the moon on atmospheric pressure, temperature, rainfall, thunderstorms, atmospheric electricity, etc.

The curve plotted from 13 years' (1886–1898) observations on temperature at Blue Hill, Mass., though somewhat irregular, agrees with curves based on similar observations at Greenwich and Oxford, England, and Oust Silosk, Siberia, "in showing a generally higher temperature between new moon and full than between full moon and new." The curve for the normal temperatures at Blue Hill from October, 1898, to February, 1899, shows that the minimum temperatures for

October, December, January, and February occurred very near the times of new moon, the interval between the minima approximating the length of a synodic period of the moon. The curve for frequency of thunderstorms in the United States shows that while the range is small it follows that based upon observations in Sweden in showing a maximum a few days preceding the greatest northern declination of the moon.

The author's general conclusions regarding the periodicity of the weather are thus stated:

"(1) That every weather period is rendered complex by the existence of periods which bear the relation of harmonics to the primary; that is, their lengths are twice, one-half, one-third, one-fourth, etc., the length of the primary. (2) The periods in different parts of the world have different phases, as, for example, in the annual period it is cold in the northern hemisphere when it is warm in the southern, and in the sun-spot period it is dry in Russia when it is wet in India. (3) At any given place on the earth's surface the harmonics, and in some cases the primaries, reverse in phase. In the case of some of the longer periods this has been traced to a movement of the center of oscillation from place to place. (4) At any given place the periods and their harmonics do not vary synchronously. Sometimes the primary period is weak, while one or more of the harmonics are strong, and the reverse."

Climatology of the Isthmus of Panama, H. L. ABBOT (*U. S. Dept. Agr., Weather Bureau Doc. 201, pp. 19, figs. 5*).—This article, reprinted from Monthly Weather Review, 27 (1899), No. 5 (E. S. R., 11, p. 430), includes data and discussion on temperature, winds, barometric pressure, and precipitation.

Report of meteorology of Scotland for the year ending September 30, 1898, R. C. MOSSMAN (*Trans. Roy. Scottish Arbor. Soc, 15 (1898), pt. 3, pp. 301-307*).

Temperature variations in the free atmosphere as measured by balloon observations, L. T. DEBORT (*Compt. Rend. Acad. Sci. Paris, 129 (1899), No. 8, pp. 417-420, fig. 1*).—The variations at different heights are charted and discussed.

Results of rain, river, and evaporation observations made in New South Wales during 1897, H. C. RUSSELL (*Rpt. Govt. Astronomer New South Wales, Sidney, 1898, pp. 220, map 1, dgms. 8*).

Notes on frost, E. B. GARRIOTT (*U. S. Dept. Agr., Farmers' Bul. 104, pp. 23*).—In this bulletin the formation of frost and various means of protection from its injuries are treated in a popular way, and so far as the nature of the subject will permit the information is made applicable to all localities rather than to restricted districts.

WATER—SOILS.

Principles and conditions of the movements of ground water, F. H. KING (*Nineteenth Ann. Rpt. U. S. Geol. Survey, 1897-98, pt. 2, pp. 59-294, pls. 11, figs. 52*).—The introductory chapter of this article contains a general discussion of the following topics: The amount of water stored in the ground (sandstone, soil, and other rocks); depth to which ground water penetrates; general movements of ground water due to gravitation, temperature changes, and capillarity; percentage of precipitation which penetrates the soil; how seepage waters find their way into drainage channels; configuration of the ground water surface; and elevation of ground water surface due to precipitation and percolation. This discussion is based largely upon results of investigations reported elsewhere.[1] The other chapters report the results of investigations by the author and others on the flow of fluids through porous media, including the study of the flow of water and air through rigid porous media, such as wire gauze, perforated sheet brass, and sandstone; through sand; and through capillary tubes. One of the main objects of the author's investigations was to test the accuracy of the Poiseuille-Meyer law, which states that "the flow is directly proportional to the pressure and inversely proportional to the depth or thickness of the stratum." The results of the investigations are reported and discussed in detail. They are briefly summarized as follows:

> "With all the observations of all of the observers, whether with sands, rock, or capillary tubes, whether with high or low pressures, and whether with long or short tubes or columns, the departures from the Poiseuille-Meyer law have been systematically either plus or minus instead of first one side and then the other, as should be expected if the departures were due to errors of observation, unless indeed some peculiarity in the many forms of apparatus is responsible for the systematic departures which have been so persistently found by nearly every observer."

It is shown that the form, diameter, and arrangement of soil and sand grains are factors of fundamental importance in determining the rate of flow. The apparatus and methods used and the results obtained in observations on these points are described in detail.

> "The general conclusion which appears to be indicated by this series is that with the smaller sizes, where the grains give a minimum pore having diameters of 0.0117 mm., 0.01361 mm., 0.01619 mm., and 0.01809 mm. and under pressures not exceeding a gradient of about 3 to 5, the flow increases faster than the pressure; but when the diameters of the pores are 0.02756 mm., 0.0248 mm., 0.03249 mm., 0.04094 mm., and 0.05821 mm. the flow does not increase so rapidly as the pressures, even when the gradient is no steeper than 1 to 5 in the three coarsest.
>
> "In other words, the flow becomes so turbulent in the larger pores that considerable amounts of energy are absorbed even under very low pressures.
>
> "Since the length of the sand columns in these cases was 12 in. (30.48 cm.), the ratio of diameter to length of tube is as 1 to 5,236 in the coarsest and as 1 to 26,000 in the finest grained sand, whereas in Poiseuille's tube the ratio of diameter to length was 1 to 361; yet a very close agreement with the law was found under a pressure of 58 times the highest pressure used here.
>
> "It would appear, therefore, that Poiseuille's law for sands and other porous media holds only within very much narrower limits than has been found true for capillary tubes."

The general applications of the facts thus observed to the movement of soil water, seepage in case of canals and rivers, the flow of wells (driven and open), and the determination of the diameter of soil particles (see p. 523) are discussed. The conclusion is reached that mathematical treatment of the problems of the movement of ground water is "inapplicable to natural conditions except those of small areas" since "the movements of ground water across long distances must take place in considerable measure through passageways larger than those which depend upon the pore space fixed by the diameters of the grains which constitute the beds themselves."

---

[1] Wisconsin Sta. Rpts. 1892, p. 129; 1898. U. S. Dept. Agr., Weather Bureau Bul. 5 (E. S. R., 4, p. 670; 5, p. 486).

In experiments with driven-well points 18 in. long and 1¼ in. in diameter, connected with an ordinary suction pump, it was found that the point did not deliver water to the pump as rapidly as required by the pump worked at ordinary speed, and the labor of pumping was greater than in case of open wells, "due to the fact that the water came in too slowly to fill the cylinder behind the piston as rapidly as the piston was raised and as a vacuum was formed behind it."

"The drive-well point, with pumps to be worked by hand, is only adapted to circumstances where small amounts of water are required. . . . The best method of increasing the capacity of the point is to increase its length.

"Where an open well can be dug to the water and then one or two 10 ft. lengths of 6 in. points sunk below this into the water-bearing beds, so that a large suction pipe can be lowered well down toward the bottom of the casing, large quantities of water may be secured if the water-bearing sands are reasonably coarse.

"It is never desirable to make the well point a part of the suction pipe if considerable quantities of water are to be raised, for the reason that a heavy shock comes upon the pump with every stroke, owing to the necessity of filling the point with new water from the ground as rapidly as the piston is raised. When the point is larger and open, the water can fall outside to relieve the shock which otherwise would come and there is less chance for a shock on the back stroke in rapid pumping."

Theoretical investigation of the motion of ground waters, C. S. SLICHTER (*Nineteenth Ann. Rpt. U. S. Geol. Survey, 1897–98, pt. 2, pp. 295–384, pl. 1, figs. 36*).—In this article an attempt is made to derive, from purely theoretical considerations, an expression for the flow of water or other fluid through a column of soil made up of grains of nearly uniform size and of approximately spherical form.

"For the purpose of constructing this formula, a study was made of the pores of the ideal spherical-grained soil, and the relation of porosity to the average arrangement of the grains was shown and made a factor in the resulting formula. The author derived as the formula for the quantity of water per second transmitted by a column of soil the following expression:

$$q = [1.0094]\frac{p\,d^2 s}{\mu\,h\,K} \text{ cubic centimeters per second,}$$

in which—

q is the quantity in cubic centimeters;

p is the difference in pressure at the ends of the cylinder in centimeters of water at 4° C.;

d is the mean diameter of soil grains in centimeters;

s is the area of cross section of the cylinder in square centimeters;

h is the height of the column of sand in centimeters;

μ is the coefficient of viscosity of the fluid;

K is a constant [for the porosity of the soil (ideal)—a table of such constants is given];

[1.0094] is the logarithm of a factor.

"Measuring q in cubic feet, p in feet, h in feet, s in square feet, and d in millimeters, this formula becomes:

$$q = [9.3036-10]\frac{p\,d^2 s}{\mu\,h\,K} \text{ cubic feet per minute,}$$

and for water at 10° C. this becomes

$$q=[1.1846]\frac{p\,d^2\,s}{h\,K}\text{ cubic feet per minute,}$$

in all of which the brackets inclose the logarithm of a factor."

The author attempts to derive a formula for determining the effective size of the soil particles by measuring the rate of flow of air through the soil. This work has been noted elsewhere (see p. 523).

The general problem of the movement of water in soils and rock was investigated and it was shown "that there exists in the case of ground-water movements what is known as a potential function, from which we may derive, in any determinate problem, the velocity and direction of flow, and the pressure at every point of the soil or rock." In the study of the vertical motion of ground water "the fact appears that a change of pressure may be brought about throughout a water-bearing medium without changing the level of the water table, and the conclusion is forced upon us that an interference with wells and underground water supply may take place without much general disturbance of the water table in the immediate neighborhood of the disturbed wells and shortened underground supply."

The problem of the flow of wells is also discussed.

"The formula found for the capacity of an artesian well which completely penetrates the water-bearing strata is as follows:

$$f=\frac{2\pi h\,(k_1a_1+k_2a_2+\ .\ .\ .\ .)}{\log_e(1+600/r)}\text{ cubic feet per minute,}$$

in which h is the amount in feet that the water is lowered by pumping, r is the radius of the well in feet, and a_1, a_2, . . . are the thicknesses in feet of the various strata, and k_1, k_2, . . . are the constants depending upon the transmission capacity of the various strata. The symbol $\log_e$ calls for the natural or hyperbolic logarithm. It is also shown that the capacity of a well is not largely influenced by the size of the bore, except as the flow is controlled by pipe friction.

"The flow from a well which does not completely pass through the water-bearing strata is found to be given by a formula similar to the above, but containing the additional term—

$$2.5\pi\,k_n\,hr,$$

in which k_n is the transmission constant for the bottom stratum.

"The interference of two, three, and several wells with one another was investigated, and results are given in tabular form, illustrating the conclusions reached. Diagrams of lines of flow are given for several cases, and a method is explained by which the lines of flow into any number of interfering wells, however placed, may be constructed upon the drafting board."

The influence of early spring tillage on soil moisture as compared with later spring tillage, F. H. KING and J. A. JEFFERY (*Wisconsin Sta. Rpt. 1898, pp. 115, 116, fig. 1*).—On two parallel fields, one clover sod and the other potato land, alternate plats were plowed (1) 6 in. deep and smoothed April 12 and disked April 29 and May 7; (2) 7 in. deep May 12 and 14. A marked contrast in the moisture content of the different plats was soon visible to the eye, the later plowed plats being drier and lighter colored than the others. Moisture determinations made May 16 showed that the earlier plowed plats on clover sod contained 3.49 lbs. per square foot and on the potato ground 2.45 lbs. per square foot more water than the later plowed plats.

A laboratory study of the effectiveness of soil mulches, F. H. KING and J. A. JEFFERY (*Wisconsin Sta. Rpt. 1898, pp. 134–148, figs. 2*).—Experiments on this subject in the laboratory and greenhouse are reported. In the laboratory experiments 3 soils "(1) a black marsh soil of a very fine, close texture and devoid of peat, which had been under cultivation but 2 years; (2) a sandy loam cultivated many years, and (3) a medium virgin clay loam from a second growth black-oak grove," were uniformly packed into cylinders 22 in. deep with a cross-section area of 0.1 sq. ft. The cylinders used were of galvanized iron painted on the inside with an acid and waterproof paint. Each cylinder had a water reservoir at the bottom, with which it was connected by a series of notches cut in the lower edge of the cylinder. The reservoir had a supply pipe and a vent tube. A layer of sand was placed in the bottom of the cylinders. The height of the soil column above the level of the water in the reservoirs was 19 in.

The object of the experiment was to determine the relative effectiveness of soil mulches 1, 2, 3, and 4 in. deep, as compared with no mulch. Each experiment was conducted in duplicate, there being 10 cylinders in each set. The mulches in each case were produced by removing the soil to the desired depth and working this into the crumbled condition, when so much was at once returned as was required to fill the cylinder level full. Water was added until the soils were nearly saturated, the marsh soil containing 56.37 per cent, the virgin clay soil 35.57, and the sandy loam 19.71 per cent. During the first two periods of the experiment (63 and 80 days) the cylinders were placed in a case through which air was drawn at an estimated rate of 3,386 ft. per hour during the first period, and 2,476 ft. per hour during the second period. During the third period (37 days) the cylinders were placed out of doors and exposed to the air and sun. The mean rates of loss of water per 100 days were as follows:

The mean loss of water in tons per acre in 100 days.

Kind of soil.	No mulch.	Mulch 1 in. deep.	Mulch 2 in. deep.	Mulch 3 in. deep.	Mulch 4 in. deep.
	Tons.	*Tons.*	*Tons.*	*Tons*	*Tons*
Black marsh soil	620.9	367.0	274.3	248.9	213.8
Sandy loam	724.1	397.1	288.8	269.2	251.8
Virgin clay loam	1,779.6	1,249.6	1,029.2	974.6	881.6

"This table shows clearly that the effectiveness of the mulches increases rapidly with the depth of each of the 3 types of soil, and that the loss of water has been much more rapid both from unmulched and from each of the mulched surfaces of the virgin clay loam than from either of the other soils.

"The rate of evaporation under the field conditions was greater than during the 80-day period in the laboratory with the 3 soils, and it was greater during the first period in the laboratory than it was during the second period. These relations should be expected because in the first and third periods the experiments started with wet mulches while at the beginning of the 80-day period the mulches were comparatively dry. Under the out-of-door conditions there was both a stronger wind movement and direct sunshine upon the soil."

Experiments were made in the plant house with the black marsh soil in cylinders 52 in. deep and 3 ft. in diameter; and with the virgin clay soil in cylinders of the same depth, but 1½ ft. in diameter. The cylinders were divided into 4 groups, 1 set not being cultivated at all, and the 3 others cultivated 1 in., 2 in., and 3 in. deep, respectively, and at intervals of 2 weeks, 1 week, and one-half week, respectively, in different cases. All soils were saturated and allowed to stand 10 days before the mulches were made. The experiments then proceeded as follows:

"In the case of the black marsh soils the surfaces were smoothed and then tamped with a 5 lb. weight and left in this condition where no mulches were developed. In the other cases the soil was stirred to the desired depth with a four-tined potato fork upon whose tines a gauge was fixed so as to slide upon 2 pieces of gas pipe resting on the rim of the cylinder, thus securing the desired depth of mulch.

"In the case of the small cylinders enough soil was removed to secure a level undisturbed surface 1¼ in. below the rim of the cylinder plus the depth of the desired thickness of mulch. Enough of the soil removed was then returned at once in a finely crumbled condition to the several cylinders to bring their surfaces to 1¼ in. below the rim.

"The cylinders were all weighed and the experiment proper begun on November 24, 1897, and continued without the addition of water to any of the soils during the first period of 30 days.

"At this time, December 24, after weighing, water was added to the surface soil of all cylinders to the amount of a rainfall of ¼ in. and 4 days later all of the mulched surfaces were stirred, using the four-tined potato fork in the manner described in preparing the mulches. All cultivations of these soils have been made in this way.

"In starting the second period of the experiment the soils stood 4 days after wetting before cultivation. Thirty-two days from the first wetting and 28 days after the first cultivation of this period all cylinders were again given the equivalent of a rainfall of ¼ in.; but following this wetting 4 days only cylinders cultivated once per week and twice per week had the soil stirred and the experiment was closed February 1, after a period of 39 days."

The losses of moisture from the 2 soils were as follows:

Losses of moisture from soils with mulches of different depths.

	Virgin clay loam.			Black marsh soil.		
	Loss of water per acre in 100 days.		Water saved by mulching.	Loss of water per acre in 100 days.		Water saved by mulching.
	Tons.	*Inches.*	*Per cent.*	*Tons.*	*Inches.*	*Per cent.*
Not cultivated	724.1	6.394	....	319.0	2.816	....
Cultivated 1 in. deep:						
Once in 2 weeks	551.2	4.867	23.88	248.4	2.194	22.13
Once a week	545.0	4.812	24.73	255.9	2.260	19.78
Twice a week	527.8	4.662	27.10	262.6	2.319	17.65
Cultivated 2 in. deep:						
Once in 2 weeks	609.2	5.380	15.88	249.1	2.200	21.93
Once a week	552.1	4.875	23.76	249.8	2.206	21.70
Twice a week	515.4	4.552	28.81	268.9	2.374	15.72
Cultivated 3 in. deep:						
Once in 2 weeks	612.0	5.280	15.49	266.2	2.351	16.53
Once a week	531.5	4.694	26.60	282.6	2.495	11.41
Twice a week	495.0	4.371	31.64	274.5	2.424	13.94

"It will be seen from the table of evaporations from the clay loam, that with each of the three depths of cultivation the percentage of moisture saved, over that which was lost from the not cultivated ground, increased with the frequency of cultivation; that is to say, if one is cultivating ground of this character 1 in. deep, then the largest saving of moisture results from stirring the soil twice per week; and when this saving over the cultivation once in 2 weeks is expressed in tons per acre the amount is 23.29 tons per 100 days, or 0.23 ton per day, and 1.6 tons per week per acre.

"If he is cultivating 3 in. deep twice per week, as against 3 in. deep once in 2 weeks, then the saving of moisture is 116.9 tons per 100 days; 1.17 tons per day, and 8.18 tons per week per acre. Or, if the comparison is made between cultivation 3 in. deep twice per week and no cultivation, then the saving of moisture is 229.1 tons per 100 days; 2.29 tons per day, and 16.03 tons per acre per week.

"If we refer to the table for the losses of moisture which have occurred under the cultivation once in 2 weeks for each depth, it will be seen that the greatest saving appears to have resulted from the cultivation 1 in. deep, and the least saving when the cultivation was 3 in. deep. These relations may possibly be an expression of a principle in tillage, but further observations will be required to establish it. . . .

"When the results from the black marsh soil are considered, they appear to stand in contradiction to those of the same soil in the first series of experiments, and from those of the virgin soil in both series. This difference, however, is much more apparent than real, and is due (1) to the fact the black soil has so very high a water capacity, and (2) to determining the losses by weighing, making no distinction between the losses from the mulches themselves and from the body of the soil."

A record is given of a series of observations with the Piche evaporometer in connection with these experiments. The rate of evaporation as thus observed is compared with the losses determined, by weighing, in the following table:

The comparative rates of evaporation from a Piche evaporometer and soil surfaces of different characters.

	Mean evaporation per acre per 100 days.	
	Tons.	*Inches.*
Piche evaporometer	1711.0	15.105
Saturated sand surface	690.1	6.094
Unstirred virgin clay loam	724.1	6.394
Virgin clay loam cultivated 1 in. deep once in 2 weeks	551.2	4.867
Virgin clay loam cultivated 2 in. deep once in 2 weeks	609.2	5.380
Virgin clay loam cultivated 3 in. deep once in 2 weeks	612.0	5.280
Black marsh soil not cultivated	319.0	2.816
Black marsh soil cultivated 1 in. deep once in 2 weeks	248.4	2.194
Black marsh soil cultivated 2 in. deep once in 2 weeks	249.0	2.199
Black marsh soil cultivated 3 in. deep once in 2 weeks	266.2	2 351

The temperature of the air under which these observations were made is also recorded.

A new method of mechanical analysis of soils, F. H. KING (*Wisconsin Sta. Rpt. 1898, pp. 123–133, figs. 4*).—It is shown in this article that the methods of soil examination in general use do not give "a very close measure of the aggregate amount of surface possessed by a unit volume of a given soil. . . . It has been the custom of different investigators to get the diameter of soil grains, either by direct measurements with a micrometer or by counting and weighing a certain number of grains and then computing the diameter of the mean grain from the specific gravity, number, and weight. But in order to

get results which are even approximately accurate a large number of measurements in three dimensions of the grains must be made, and a large number of the grains must be counted and weighed." Even when the soil is separated into a large number of sizes "it is not possible to arrive at a very exact knowledge of the real surface which the soil may possess, per unit, volume or weight." With the assistance of Prof. C. S. Slichter of the University of Wisconsin, the author has devised a method for studying the pore space in soils, based upon the laws of the flow of air through capillary tubes. The apparatus and method are described as follows:

"*Apparatus.*—The apparatus for determining the effective size of soil grains consists of a water receptacle A, fig. 2; an aspirator bell B; an air tube 1, 1, 1, leading from the bell to the air chamber D; a soil tube C, C, provided with a tight cap 4 at one end and a cap with wire gauze at 3.

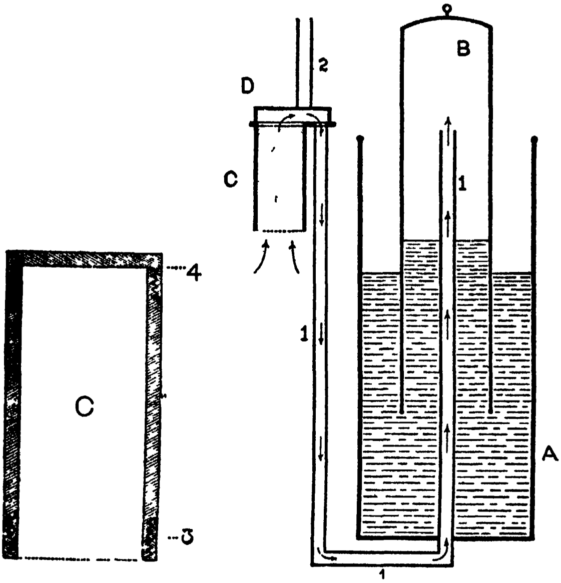

FIG. 2.—Apparatus for determining the effective diameter of soil grains.

"The air meter is a clock gear . . . and the bell is calibrated to read seconds of dial in cc. The pressure gauge connects at 2, and . . . consists of a pressure tube rising 1 in 10, and connected with a large water receptacle used to avoid reading the gauge at both ends. Pressures can be read to tenths of a mm. The pressure is developed by a weight. The soil tube C is given a capacity of 100, 200, or 300 cc., according as the soil used is fine or coarse, the area of cross section being 11.3903 sq. cm., in our case. Two bells are also used, one in which 1,000 cc. and the other 3,000 cc. may be measured, to be used with the fine and coarse soils.

"*Method of using the apparatus.*—To fill the soil tube C, the cap 4 is screwed down close and the cap 3 removed. The sample is then introduced in small lots at a time, 3 to 5 cc., and gently tamped with a flat-faced pestle until level full, then it is held rigidly between the thumb and fingers and, resting on the table, jarred by repeated light blows from a light stick, turning the tube around as the jarring progresses. This is repeated as long as any settling can be produced, and more soil is added and finally 'struck off' and made even full with a piece of plate glass.

"The object is to secure the closest possible packing. If violent jarring is resorted to, or if the tube is not pressed firmly on the table while jarring, the soil will be loosened up.

"Soils may be sorted by means of screens and the effective size of the separates determined, or the whole soil may be used as desired. Where the aim is to get a measure of the finest grains, the air-dry sample is rubbed down in a mortar with a rubber-tipped pestle to remove lumps. If it is desired to investigate the soil as to its normal crumb structure then the destruction of these would be avoided.

"*Formula for determining the effective diameter*—Prof. Slichter's formula for determining the effective diameter of the grain is as follows:

$$d^2 = k \frac{h}{spt} \; [8.9434 - 10] \text{ where}$$

d = diameter of grain in cm.
h = length of sand column in cm.
s = area of cross section of sand column in sq. cm.
p = pressure in cm. of water at 20° C.
t = time in sec. for 5,000 cc. of air to flow through at a temperature of 20° C.
[8.9434 — 10] is a logarithm of a constant.
k is a constant taken from the following table:

Pore space.	Log. k.	d.	Pore space.	Log. k.	d.
Per cent.			*Per cent.*		
26	1.9258	563	37	1.4173	377
27	1.8695	500	38	1.3816	371
28	1.8195	490	39	1.3445	367
29	1.7701	502	40	1.3078	353
30	1.7199	467	41	1.2725	351
31	1.6732	455	42	1.2374	345
32	1.6277	430	43	1.2024	339
33	1.5847	438	44	1.1690	320
34	1.5409	410	45	1.1370	312
35	1.4999	407	46	1.1058	329
36	1.4592	409	47	1.0729	....

The observed and computed flow of water through sand of different diameters are shown in the following table:

Observed and computed flow of water through sands of different diameters under a pressure of 1 cm. of water.

Grade of sand.	Diameter of grains.		Flow of water through the sample.		
	By counting and weighing.	By aspiration of air.	Observed.	Computed from aspiration diameter.	Computed from count and weight diameter.
	Mms.	*Mms.*	*Gms.*	*Gms.*	*Gms.*
8	2.755	2.54	2,296	2,277	2,680
7	1.993	1.808	1,080	1,132	1,372
6	1.588	1.451	756	757	909.1
5½	1.345	1.217	542	522	638.6
5	1.157	1.095	504.6	453.2	499.6
4	.976	.9149	329.2	297.5	326.6
3	.8017	.7988	210	193	194
2	.6653	.7146	138.6	122	106.2
1	.5824	.6006	94.8	80.6	75.7
0	.4891	.5169	72.3	66.8	59.8

"When it is observed that the flow of air was not measured with the identical sample of sand through which the flow of water was measured, and that it was in a different piece of apparatus, and further, that the flow of fluids through soils varies, theoretically, as the squares of the diameters, it will be conceded that, while there is not as close an agreement between the observed and the computed results as could be wished, the agreements are so close as to show that for such materials there is much more than a chance agreement. It will be seen further that, in general, there is a closer agreement between the observed flows and those computed from the aspirator diameters than with those computed from the count and weight diameters."

Analysis of drainage waters, C. A. Goessmann, H. D. Haskins, and R. H. Smith (*Massachusetts Hatch Sta. Rpt. 1898, pp. 134–141*).—Analyses of the drainage water from 11 plats which have been used in fertilizer experiments for a number of years are reported. It was found that wherever muriate of potash had been used "exceptional quantities of the chlorids of calcium and magnesium" were present in the drainage water. "The belief that a liberal use of muriate of potash had resulted in wasting in an exceptional degree in particular the lime resources of the soil and thereby reducing the yield of the crops has since been confirmed. The annual yield of the crops has been restored to its former satisfactory condition after a liberal addition of air-slaked lime to the manures used for years upon the field in question."

A comparative study of rapid processes of purifying water, F. MALMÉJAC (*Jour. Pharm. et Chim., 6. ser., 10 (1899), No. 8, pp. 344-347*).—Comparative tests of the alum methods of Babes and Werner and the ferric chlorid methods of Almen and Manget are reported.

Congo soils, MASSON (*Bul. Agr. [Brussels], 15 (1899), No. 4, pp. 265, 266*).—Chemical analyses (water, organic matter, phosphoric acid, lime, potash, and nitrogen) of 34 samples are reported.

The aeration of the soil, E. WOLLNY (*Fühling's Landw. Ztg., 48 (1899), Nos. 10, pp. 377-382; 11, pp. 401-405; 12, pp. 441-445*).

Subsoilers, M. RINGELMANN (*Jour. Agr. Prat., 1899, II, No. 44, pp. 630-633, figs. 8*).—Various subsoil plows of French manufacture are described.

FERTILIZERS.

Analysis of kraal manure, J. LEWIS (*Agr. Jour. Cape Good Hope, 15 (1899), No. 8, pp. 517-521*).—Analyses of 11 samples of manure accumulating in sheep corrals and 3 samples of the ash of such manure are reported. The averages of these analyses are as follows:

Composition of sheep-corral manure and manure ash.

	Water.	Ash.	Nitrogen.	Lime.	Potash.	Phosphoric acid.	Chlorin.
	Per cent	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Manure (average of 11 analyses)	13.52	41.28	1.31	7.08	2.84	1.26	1.25
Manure ash (average of 3 analyses)	2.23	*a* 87.12	....	16.97	7.60	2.59	1.57

a Pure ash.

The phosphoric acid was all citrate-soluble.

Observations with dried blood and two kinds of leather refuse as the sources of nitrogen for growing rye in presence of acid and alkaline phosphates, C. A. GOESSMANN (*Massachusetts Hatch Sta. Rpt. 1898, pp. 123-127*).—This is a continuation of experiments in boxes briefly described in the report of the State Station for 1894 (E. S. R., 7, p. 297). The method followed was the same as in the earlier experiments, except that the phosphates used were dissolved boneblack and Thomas slag, and potash was added in the form of the sulphate. The 2 kinds of leather refuse were the Philadelphia Tankage (steamed leather waste) used in the previous experiments and raw ground sole-leather waste. Rye was again grown. The moisture content of the soil was maintained at 15 to 18 per cent. Data relating to the weight and composition of the crop are reported. The following conclusions are drawn from the results:

> "The alkaline phosphate (phosphatic slag meal) has under fairly corresponding conditions increased the availability of the nitrogen contained in steamed leather, in leather scraps, and in dried blood in a higher degree than the acid phosphate. The influence is apparent alike in the general character of the entire plant and in the composition of the kernels. The difference in the relative agricultural value of both articles as nitrogen sources remains, however, the same; for leather in any form, without a previous destruction of the tanning principle, tannin, is worthless for manurial purposes."

Is the phosphoric acid of mineral phosphates available to cultivated plants? D. N. PRIANISHNIKOV (*Izv. Moscow Selsk. Khoz. Inst., 5 (1899), No. 1, pp. 90–110; Ann. Agron., 25 (1899), No. 4, pp. 177–187*).—The results of extensive pot experiments by the author may be summed up as follows: With regard to their behavior toward mineral phosphates plants can be divided into such as can, without the aid of the soil, dissolve and utilize the phosphoric acid of these materials and such as are not capable of doing this. To the former group belong the lupines, peas, buckwheat, and white mustard; to the latter belong the cereals. There exist of course plants which stand in an intermediate relation to these 2 classes.

Similarly, we must distinguish soils which are capable of decomposing the mineral phosphates from those which can not do this. For the mineral phosphates to be effective as fertilizers the cooperation of certain properties of the soil or of the plants is necessary. Certain soils have the property of rendering the phosphoric acid of mineral phosphates available for cereals and other plants. In the author's experiments the so-called "podzols" (which consist of very fine siliceous material mixed with some organic matter) were most effective in this respect, while forest and peat soils also possess the property to some extent. Certain black (chernozem) soils experimented with were without action on the mineral phosphates, and the author suggests that soils originally active in this respect may become inactive after a period of cultivation in which barnyard manure is used. The necessity of taking these facts into consideration in analyzing mineral phosphates to determine their fertilizing value is pointed out.—P. FIREMAN.

Notes on wood ashes, C. A. GOESSMANN (*Massachusetts Hatch Sta. Rpt. 1898, pp. 117–119*).—The variations in the composition of the wood ashes examined in 1897 and 1898 are discussed. In a large number of the samples analyzed in 1898 the potash was below the minimum guarantee (4.5 per cent), being inferior in this respect to samples examined in 1897.

Seaweed as a fertilizer (*Florida Agr., 26 (1899), No. 39, p. 600*).

Analyses of commercial fertilizers sold in Maryland, H. B. MCDONNELL ET AL. (*Maryland Agr. College Quart., 1899, No. 5, pp. 49*).—This number includes brief notes on the valuation of fertilizers, a partial list of fertilizers licensed in Maryland during 1899, and tabulated analyses and valuations of 408 samples of fertilizers examined, February–July, 1899.

Report on official inspection of commercial fertilizers and agricultural chemicals in 1898, C. A. GOESSMANN (*Massachusetts Hatch Sta. Rpt. 1898, pp. 105–114*).—Three hundred and sixty-three samples, representing 264 distinct brands of fertilizers, were examined in 1898. The agreement of the analyses with guarantees in 1897 and 1898 and the valuation of fertilizers are discussed and a list of fertilizer manufacturers securing certificates for sale and the brands licensed during the year ended April 30, 1899, is given.

Analyses of fertilizers, C. A. GOESSMANN (*Massachusetts Hatch Sta. Bul. 62, pp. 20*).—This bulletin reports analyses of 195 samples of fertilizers, including wood ashes, cotton-hull ashes, nitrate of soda, muriate of potash, kainit, tankage, ground bone, cotton-seed meal, flax meal, bone, acid phosphate, wool refuse, Jadoo fiber, soils, and mixed fertilizers.

Fertilizer analyses, R. C. KEDZIE and L. S. MUNSON (*Michigan Sta. Bul. 17[illegible], pp. 325–337*).—This bulletin gives the text of the State fertilizer law; a discussion of the objects and results of inspection and the composition and character of different classes of fertilizers; a schedule of commercial prices, with notes on the valuation of fertilizers; explanation of terms used in fertilizer analysis; and tabulated analyses of 68 samples of commercial fertilizers inspected during 1899.

Analyses of commercial fertilizers, B. W. KILGORE ET AL. (*Mississippi Sta. Bul. 59, pp. 29*).—This bulletin contains brief notes on the fertilizer trade in the State, terms used in analysis, valuation, and the provisions of the fertilizer law, with tabulated analyses and valuations of 166 samples of fertilizers collected during the season of 1897–98.

Commercial fertilizers, F. W. WOLL (*Wisconsin Sta. Rpt. 1898, pp. 209–219, 283, 284*).—This includes explanations of fertilizer terms, notes on valuation, tabulated analyses of 5 samples of fertilizers, with a brief discussion of fertilizers for lawns and text of the Wisconsin fertilizer law.

Gas, oyster-shell, and stone lime, H. B. MCDONNELL and F. P. VEITCH (*Maryland Agr. College Quart., 1899, No. 4, pp. 8*).—This article discusses briefly the chemical composition and relative agricultural value of different forms of lime and reports analyses of 16 samples of agricultural lime.

"The analyses show that stone and shell lime contain from two to three times as much actual lime as is contained in the same weight of gas lime. By measure the difference is still greater. This, together with the fact that in gas lime the lime is mostly in the form of carbonate and less active than quicklime, and also that the gas lime contains compounds which may act injuriously, leads to the conclusion that it is poor economy for the farmer to buy gas lime at 2 cts. per bushel when he can get oyster-shell lime for 5 cts., even not taking into consideration the question of the cost of transportation.

"Oyster-shell lime contains as much lime as the average stone lime, so that the stone lime, at 10 cts. per bushel, can not compete with the shell lime at 5 cts. on equal terms for agricultural purposes. Where transportation is largely in favor of the stone lime, however, it will be used."

Notes on fertilizers suitable for raising plants in pots and greenhouses, C. A. GOESSMANN (*Massachusetts Hatch Sta. Rpt. 1898, pp. 119–123*).—Analyses of samples (1 each) of plant food in pellet form and of liquid fertilizer are reported and general suggestions are made regarding the use of fertilizers in pots and under glass, with formulas for mixtures.

The situation of the nitrate of soda industry in Chile, MAIZIÈRES (*L'Engrais, 14 (1899), No. 18, pp. 420, 421*).

Perchlorate in 1898 (*Bul. Agr. [Brussels], 15 (1899), No. 4, pp. 252, 253*).—Reports determinations of perchlorate in 19 samples of nitrate of soda. The amount of this substance varied from 0.15 to 8.16 per cent.

The world's production of phosphates, MAIZIÈRES (*L'Engrais, 14 (1899), No. 42, pp. 995, 996*).

Influence of phosphoric acid on the growth of cereals, J. STOKLASA (*L'Engrais, 14 (1899), No. 41, pp. 972, 973*).

A new contribution to the study of phosphates, C. SCHREIBER (*Rev. Gén. Agron [Louvain], 8 (1899), Nos. 4, pp. 179–185; 5, pp. 210–221; 6, pp. 280–284*).

The basis of the selling price of phosphatic slags, J. GRAFTIAU (*Ann. Sci. Agron., 1899, II, No. 1, pp. 117–121*).

The production of cereals and the consumption of phosphatic fertilizers, MAIZIÈRES (*L'Engrais, 14 (1899), Nos. 40, pp. 948, 949; 41, pp. 971–973*).

FIELD CROPS.

Report of the agriculturist, W. P. BROOKS (*Massachusetts Hatch Sta. Rpt. 1898, pp. 44–63, 76–85*).—This report gives the results of various field experiments in 1898. The experiments are mainly in continuation of former work (E. S. R., 10, p. 626).

Soil tests were made with corn and onions at the station and with oats in two other parts of the State. The soil test with corn was made on a field on which soil tests have been in progress for 10 years, the rotation having been as follows: Corn, corn, oats, grass and clover, grass and clover, corn followed by mustard as a catch crop, rye, soy beans, white mustard, and corn. The same fertilizer applications were made each year. This season the plats receiving only nitrate of soda, phosphoric acid, or potash yielded at the rate of 20.6, 18.5, and 19.8 bu. of corn per acre, respectively. The nitrate of soda and dissolved boneblack plat yielded at the rate of 30 bu. per acre, while the plat with nitrate of soda and potash yielded at the rate of 10.9 bu.

"The yield of the plat which for 10 years has received only phosphoric acid and potash (41.2 bu. per acre) illustrates in a striking way the comparative independence of the corn crop of supplied nitrogen upon this soil. The crop raised where nitrogen, phosphoric acid, and potash have been yearly applied . . . shows that profitable results may be obtained by the use of fertilizers alone. The yearly cost of the application to this plat has been from $10 to $12. The crops have not been much inferior to those on the plat to which manure at the rate of 5 cords per acre has been yearly applied. The two crops this year are, respectively, for the fertilizer, 55.9 bu.; for the manure, 67.7 bu. The extra 11 bu. of corn will not cover the added cost of the manure as compared with the fertilizer, and in earlier years the differences in yield have been relatively much smaller than this year."

The soil test with onions was made on land which had been used for this kind of work for 9 years. Heretofore the fertilizer application had been like those applied in the soil test with corn, but this season the quantities were doubled, nitrate of soda, dissolved boneblack, and muriate of potash being applied at the rate of 320, 640, and 320 lbs. per acre, respectively. The results show that the supply of phosphoric acid had a greater influence than either the nitrogen or potash. The plat fertilized with nitrate of soda and dissolved boneblack yielded at the rate of 116.9 bu., while the plats which had received muriate of potash in addition yielded only 16.3 bu. per acre. The author concludes that the results were influenced by injurious effects of muriate of potash.

Excessive rains interfered with the soil tests with oats in one case, but in the other the results were quite conclusive. Nitrate of soda alone and in all its combinations gave a marked increase in yield, while the use of other fertilizers, without nitrate of soda, was almost without effect. Barnyard manure, at the rate of 5 cords per acre, did not give profitable results.

Grass and clover were grown on plats manured with 1 cord of barnyard manure or ½ cord of barnyard manure and 40 lbs. of muriate of potash. The results were in favor of the manure alone, but the increase in yield of hay was not sufficient to cover the larger cost.

The details of the comparison of a special corn fertilizer and a fertilizer richer in potash on grass and clover have been previously described (E. S. R., 10, p. 626). The results this season show that the application of the fertilizer richer in nitrogen and phosphoric acid yielded at the rate of 150 lbs. of hay and 80 lbs. of rowen per acre more than the fertilizer richer in potash. The plats which received the larger amount of potash did not show a good development of clover, which is attributed to a difference in soil conditions and the long-continued use of liberal amounts of muriate of potash.

The plats on which leguminous crops as nitrogen gatherers had been tested (E. S. R., 10, p. 627), were plowed and treated with 200 lbs. per plat of partially air-slaked lime and with different fertilizer applications, and then sown to oats. Potash was applied in the form of muriate and sulphate. The average yields were as follows: Plats receiving no nitrogen, 21.40 bu. of grain and 900 lbs. of straw per acre; plats receiving muriate of potash, 32.05 bu. of grain and 1,595 lbs. of straw per acre, and plats receiving sulphate of potash, 35.20 bu. of grain and 1,416.7 lbs. of straw per acre. Unfavorable weather interfered with the harvesting of the crop and caused a loss of grain through shelling. The different sources of nitrogen, considering the yield of straw, ranked in effectiveness as follows: Nitrate of soda, sulphate of ammonia, dried blood, and barnyard manure. After harvest, without further manuring, the land was sown to Mammoth red clover which made an excellent growth during the fall.

Clover on soil fertilized with muriate of potash winterkilled badly as compared with clover on sulphate of potash plats, but additional seed sown on all plats without replowing in the spring gave fairly even results. Muriate of potash gave much better results as a fertilizer for corn than the sulphate, but it is believed that the apparent difference may not be due to the fertilizer. Sweet clover showed no difference between the 2 forms of potash. Analysis of sweet clover showed that from June 6 to July 10 the dry matter increased from 3,661.6 lbs. to 7,573 lbs., and the nitrogen from 136.8 lbs. to 192.5 lbs. per acre. As a seed producer the crop did not prove very successful.

Experiments in manuring grass lands with wood ashes, ground bone, muriate of potash, and barnyard manure in rotation have been in progress since 1893 on 3 plats, each over 2 acres in size. For the entire series the plats when dressed with manure, averaged 7,211 lbs. of hay and rowen per acre; when receiving ground bone and potash, 6,671 lbs., and when receiving wood ashes, 6,541 lbs.

Extensive variety tests were made with potatoes. A number of varieties were tested for the first time, and the best 25 varieties as indicated by previous tests were given further trial. Owing to blight, the yields were small and the results inconclusive. The author believes that King of the Earliest and Early Ohio, Salzer Earliest and Bliss Triumph, and Mills Banner and Livingston Banner are identical, and that White Beauty and Cambridge Russet differ but very slightly. A comparison of seed potatoes of Beauty of Hebron and Early Rose from different localities resulted in a variation of yield of about 50 per cent for each variety. The variation in productiveness of exact halves of tubers by weight with 5 eyes in the same part of the tuber amounted to over 37 per cent, and between tubers of the same variety to about 22 per cent.

Investigations on the potash requirements of barley, T. Remy (*Untersuchungen über das Kalidüngerbedürfnis der Gerste. Berlin: P. Parey, 1898, pp. 83*).—This book contains a discussion of the literature on the fertilizing of barley, and gives the detailed results of extended pot experiments with different forms of potash, used alone in varying amounts and combined with other commercial fertilizers, on soils of different origin to determine its effect on the yield, chemical composition, and water requirements of barley, the potash requirements of different varieties of barley, and the secondary effects of potash fertilizers in rendering available the nitrogen of the soil. A summarization of the experience obtained in the culture of barley for brewing purposes on light soils is given in the final chapter.

In all the experiments zinc pots 25 cm. in diameter and with a soil capacity of 15 kg. were used. The plants were watered with distilled water, both surface and subwatering being practiced. The moisture was held at from 40 to 60 per cent of saturation of the soil. The Hanna variety of barley, except when otherwise noted, was employed in all tests and 20 plants grown in each pot.

Experiment A (pp. 8–23).—This experiment was made to determine the potash requirements for barley culture of soils of different origin. Five kinds of soils were employed—3 clay diluvial sands having different percentages of fine earth, a thin, sandy diluvial clay, and a light, coarse sand from the Spree Valley. Mechanical analyses are given of the different soils in every case, and 5 series of experiments, including 8 pots in each series, were carried out with each soil. One series of pots served in each case as a control, and 0.5, 1, and 2 gm. of potash as carbonate were added to each pot in series 2, 3, and 4, respectively. The fifth series received 2 gm. of potash as carbonate per pot, and, in addition, 0.5 gm. of nitrogen in the form of ammonium nitrate.

The growth of the grain and straw and the amount of potash taken up by the crop in each series are tabulated in detail and discussed, and modifying factors noted. The following table is a summarization of this data:

Potash content and yield of barley grown on soils of different origin and fertilized with increasing amounts of potash.

Origin of soil.	Series I—No potash.		Series II—0.5 gm. potash.		Series III—1 gm. potash.		Series IV—2 gm. potash.		Series V—2 gm. potash + 0.5 gm. nitrogen.	
	Total yield.	Potash in crop.	Total yield.	Potash in crop.	Total yield.	Potash in crop.	Total yield.	Potash in crop.	Total yield.	Potash in crop.
	Gm	*Gm*	*Gm.*	*Gm.*	*Gm.*	*Gm*	*Gm.*	*Gm.*	*Gm.*	*Gm.*
Clayey diluvial sand from Löhme	144.3	0.85	166.5	1.28	169.1	1.72	161.1	2.09	165.1	1.93
Thin sandy diluvial clay from Lohenbrünzow	128.7	.89	135.0	1.25	142.4	1.61	147.0	2.07	151.0	2.07
Clayey diluvial white sand from Nenndorf.	88.3	.45	144.7	.97	142.5	1.39	142.7	1.96	151.0	2.09
Clayey diluvial sand from Sammenthin.	86.7	.43	126.3	.89	124.8	1.28	135.9	2.01	141.2	2.02
Light loamy sand from Berlin experimental fields	36.0	.14	83.0	.56	91.5	.81	95.8	1.02	182.0	1.55

A second experiment in connection with this work, to determine the effect of sudden variation in day and night temperature on the growth of barley and the availability of fertilizers for plant use, was carried out in pots surrounded with a sheath of wadding and set in saucers 10 cm. deep, filled with water, and compared with pots handled in the usual manner. On the whole, the largest crops were obtained from the pots handled in the usual manner. The differences, however, were considered too small to form a basis for definite conclusions.

Experiment B (pp. 23–27).—The dependence of the availability of potash for barley on the form of the potash and on the amount of nitrogen present in light soils, was determined in soils taken from a sandy field in which potatoes had been grown the preceding season. Three series of pots were used with 15 pots in each series. No potash was used in the first series. In the second series 1.5 gm. of potash in the form of kainit was added to each pot. In the third series each pot received the same amount of potash in the form of carbonate. The 15 pots in each series were divided into 5 groups. The first group received no nitrogen while 0.51, 1.02, 1.53, and 2.04 gm., respectively, of nitrogen in the form of ammonium nitrate were added to each pot in the remaining series. The detailed results of the experiment are given in tabular form and discussed. The average yield of plants grown in pots fertilized with kainit was 11.3 gm. more than those in the control series, while the excess yield of plants grown in pots fertilized with potash in the form of carbonate was only 2.3 gm. more than those grown in the controls. Increasing the amount of available nitrogen increased the vigor of the plants, the total yield of the crops, and the ability of the plants to better utilize the potash applied.

Experiment C (pp. 27–30).—This experiment was made for the purpose of determining the effect of different potash salts and of the ordinary impurities or secondary ingredients found in these salts, on the growth of barley on humus soils. Eight series of pots, with 4 pots in each series, were filled with soil from a cultivated field comparatively rich in humus. Series 1 were used as checks. Series 2 received 1 gm. of potash per pot in the form of sulphate; series 3, 1 gm. in the form of carbonate; series 4, 1 gm. in the form of kainit; series 5, potassium-free secondary constituents obtained from 7.9 gm. of kainit; series 6, the same as series 5 with the addition of 1 gm. of potash in the form of sulphate; series 7, the same as series 5 with the addition of 1 gm. of potash in the form of carbonate; and series 8, 1 gm. of potash in the form of sulphate plus 1.13 gm. of water-free soda. The yields in grain and straw are recorded for each pot in each series. The effect of the potash in any form was not very marked. Pots fertilized with the secondary constituents alone gave increased yields over the checks but hardly as good as potash alone. Pots fertilized with potash in the form of carbonate with the addition of the secondary constituents gave increased yields over those fertilized with potash in the form of sulphate plus the secondary constituents. Kainit proved a superior form of potash to either the sulphate or the carbonate.

Experiment D (pp. 30–33).—This was an experiment made to compare the potash requirements of Selchower, Heine Improved Chevalier, and Goldthorpe varieties of barley. The data for the tests are recorded in detail. The results were inconclusive.

Experiment E (pp. 33–36, 63–66).—In this experiment the relation of different potash manures to certain nitrogen fertilizers in the production of barley was studied, as well as the effect of potash on the water requirements of the crop. Quartz sand, practically free from nitrogen or potash, was employed. The test was made in 2 series of pots with 16 pots, divided into 4 equal groups in each series. Each pot received basal fertilizers of the essential elements, and, in addition, quicklime, magnesium sulphate, and chlorid of iron. Pots in series 1 received 0.65 gm. of nitrate nitrogen. Pots in series 2 received the same and, in addition, 0.65 gm. of poudrette. Group 1 in each series was used as a check, while each pot in groups 2, 3, and 4 received 0.75 gm. of potash as sulphate, as kainit, and as carbonate, respectively. The yield of grain, straw, and roots, number of heads matured, water requirements of each pot, etc., are shown in tabular form. The best yields throughout were obtained in the series fertilized with nitrate nitrogen alone, and the group fertilized with kainit gave better results than either the sulphate or carbonate groups. The water requirements of the crop were found to be considerably lessened by the use of potash fertilizers, the least amount being required by the crop fertilized with kainit.

Experiment F (pp. 36–39).—The effect of different magnesia compounds on the yield of barley was especially studied, 18 pots divided into 2 equal series, A and B, being used for this purpose. Each series received basic fertilizers, and each pot in series A received in addition 1 gm. of potassium carbonate and in series B 1 gm. of potassium sulphate. Three pots in each series were used as checks. Three others in each series were fertilized with 1 gm. of magnesium chlorid each, and the remaining 3 in each series were given 1 gm. of magnesium sulphate each. Plants in the pots fertilized with magnesium chlorid grew at first with difficulty. At the harvest period, however, they gave the greatest total yields in every case, the yields being on an average about 9 per cent greater than the checks and 5.3 greater than those fertilized with magnesium sulphate. Plants in the carbonate of potash series gave better yields than those in the sulphate of potash series.

In all the experiments the percentage of germination and energy of germination was normal, and no special influence of the potash on the structure, thickness, or fineness of the barley glumes or the color of the grain was apparent. The proportion of glumes to kernel was in inverse ratio to the starch content of the grain. The percentage of glumes to grain is tabulated for experiments A and B, and the weight in grams of 1,000 kernels of grain given for each pot in every experiment. In nearly every instance potash fertilizers increased the weight of the grain, but a steady decrease in weight of grain followed each successive addition of nitrogen beyond what was sufficient for the normal development of the plant. The protein and starch content of the grain were determined in each experiment. A steady decrease in protein content is noticeable throughout the test with each increasing amount of potash, and this is regularly followed by a nearly corresponding increase in the starch content. The data for all the experiments are arranged with regard to the potash content of the dry matter of the crop from each pot, and to the percentage of potash applied which was utilized in the development of the crop. The effect of potash fertilizers in rendering the nitrogen of the soil available to the plant was also studied in considerable detail. Results of this work lead to the conclusion that potash renders nitrogen available that otherwise would not be available, and that potash in the form of kainit is most efficient for this purpose.

Lupines for green manure, J. B. Davy (*California Sta. Bul. 124, pp. 31, pls. 5*).—Botanical descriptions and notes are given on the history, culture, and food and manurial value of 13 species or varieties of lupines, grown as agricultural crops in this and other countries; together with the results of culture experiments with 7 of the more important of these varieties grown at the station and substations, and a test of the relative rates of rotting of the same varieties when turned under for green manures. A bibliography of 20 works bearing on the subject is appended.

The record of the culture tests includes data on the seed sown, date of sprouting, flowering, and full flower, yield, and the weekly growth of each variety tested. The pink lupine (*Lupinus pilosus roseus*) and the large blue lupine (*L. pilosus cœruleus*) are considered the best of the different varieties tested for green manuring on the heavy, strong, calcareous soils of middle California. The small blue lupine (*L. angustifolius cœruleus*) was preeminently the best variety tested at the Chino Valley Substation, but is subject to root rot. For light, noncalcareous soils the yellow lupine (*L. luteus sativus*) is recommended because of its rapid decomposition when plowed under.

A portion of the lupine plats under observation were turned under March 18. On April 22 they were examined to determine the relative degrees of decomposition which the different varieties had undergone. The yellow lupines were thoroughly rotted. A considerable amount of fibrous matter of the succulent (*L. affinis*) and small white lupine (*L. angustifolius diploleuca*) still remained undecomposed. The pink and large blue lupines were not quite as well decomposed as these latter, but were somewhat better than the small blue or narrow leaved lupines (*L. angustifolius*), the foliage of which latter were well rotted but the stems still very fibrous.

The bulletin contains a short introduction on green manure crops by E. W. Hilgard.

How to get extra-early potatoes, W. L. HALL (*Kansas Sta. Press Bul., Mar. 6, 1899*).—Part of the work here noted was reported in 1897 (E. S. R., 10, p. 149). In 1898, one half of a lot comprising four varieties of early potatoes was placed in shallow boxes with the seed end up and packed around with sand as previously described, except that the sand was kept moistened. The other half was put in open boxes and placed in a light dry room having an average temperature of 50° F. Both lots were planted March 26. Parallel rows of potatoes from the storage cellar were planted with them at the same time for comparison. The sand-sprouted tubers gave the earliest yields. From the 2 years' experience the author concludes that whole tubers sprouted in rather moist sand and planted about March 25 give the best results and produce tubers suitable for table use 7 to 10 days earlier than the same variety planted at the same time but not so sprouted.

Progress of the sugar-beet industry in the United States in 1898, C. F. SAYLOR and H. W. WILEY (*Washington: Government Printing Office, 1899, pp. 162*).—The report is in continuation of the report for 1897 (E. S. R., 10, p. 741).

Report of special agent, C. F. Saylor (pp. 6–129).—This discusses in a comprehensive manner the increase in the use of sugar in this country, sugar-beet production in this country in 1898 by States, the conditions requisite for growing sugar beets, general cultural methods, factory conditions, the prospects for new factories in different States, the effect of the beet-sugar industry in promoting stock feeding and dairy industries, manufacture of alcohol from sugar beets, production of sugar beet seed, results of experiments in growing sugar beets in the different States in 1898, including analyses of the crop in some instances; gives a description of the process of manufacturing sugar from beets by G. S. Dyer; and a general account of the Island of Puerto Rico as regards its industries and exports, with special reference to sugar, labor, and other economic features.

The cost of growing, harvesting, and manufacturing cane sugar and shipping it to New York from Puerto Rico is estimated at from 1.82 to 2.044 cts. per pound, exclusive of import duty, or 3.5 to 3.724 cts. per pound with this item added. This estimate leaves out of consideration interest on the money invested in the plant and insurance on the sugar in transit. The sugar exports from Puerto Rico to this country are equal to about 3 per cent of our total importations. Under the best possible conditions it is thought this amount might be doubled. The difficulties confronting the Puerto Rico planters seem to be inefficient labor, undeveloped condition of roads, and, with but few exceptions, primitive methods of manufacture. The limited economic value of the sugar-cane by-products, as compared with sugar-beet pulp, places the production of sugar from beets in this country on a competitive basis with the cane-sugar industry, which will make it, in the opinion of the author, "master of the situation."

Report of the chemist, H. W. Wiley (pp. 131–155).—This is a report on the distribution of sugar-beet seed by the Department during the season of 1898, and on the analysis of sugar beets received from the different States. In all, 20,543 lbs. of seed were distributed to the different States, and 1,713 analyses were made. The analyses are tabulated by States and counties, and suggestions are made relative to the adaptability of the different States to the sugar-beet industry. The following table shows some of the results for some States from which the larger number of samples were analyzed:

Analyses of sugar beets grown in a number of States in 1898.

State	Number of samples.	Number of counties represented.	Average results.			Maxima.		Minima.	
			Weight.	Sugar in the beet.	Purity coefficient.	Sugar in the beet.	Purity coefficient.	Sugar in the beet.	Purity coefficient.
			Ounces.	*Per cent.*		*Per cent.*		*Per cent.*	
Colorado	50	20	22	13.7	80.1	17.6	92.5	10.0	[illegible]
Illinois	38	19	20	10.2	75.2	13.3	88.6	6.3	[illegible]
Indiana	88	26	21	10.1	75.5	14.5	87.2	4.5	51.0
Iowa	147	32	25	11.4	76.1	15.7	87.3	3.9	48.7
Maryland	31	15	22	10.4	76.0	14.2	84.9	6.6	66.7
Michigan	34	18	28	13.2	81.9	18.6	89.3	9.8	50.4
Minnesota	21	9	22	12.7	78.7	16.2	88.0	9.6	68.8
Missouri	43	27	17	8.5	68.6	16.8	87.7	3.9	50.9
Nevada	42	1	12	18.5	85.9	21.7	91.7	14.8	79.8
New Jersey	33	7	20	11.1	77.5	14.2	88.2	7.5	66.5
New York	328	22	21	12.6	80.5	16.8	90.9	5.4	53.8
Ohio	409	64	24	11.0	77.1	15.7	91.9	6.0	58.0
Pennsylvania	81	21	21	11.6	78.1	15.7	87.3	6.2	[illegible]
South Dakota	24	8	16	13.9	78.6	17.9	89.5	9.1	67.0
Texas	49	23	25	9.5	69.8	15.0	82.7	3.4	[illegible]
Vermont	68	12	22	13.2	82.8	16.3	91.2	6.4	[illegible]
Virginia	43	15	20	8.9	72.4	14.3	83.9	4.9	51.5

The author calls attention to the fact that "in very few cases has the number of samples here been sufficiently large to justify a final decision in regard to the suitability of the locality for beet growth," and refers to the work done by the experiment stations for further data regarding particular States.

"So far experience has shown that south of the bounding area of the isotherm of 71 degrees for the months of June, July, and August the cultivation of the sugar beet can not be profitably extended very far. North of the limit of the belt, however, the extension of the culture of the beet can be pushed just as far as the climate will permit the ripening of the crop and the harvesting and the care thereof before the freezing of winter sets in. Our experience in this country has shown that the farther north, other things being equal, beet culture is practiced the better the quality of the beets produced."

The sugar beet in Montana, F. W. TRAPHAGEN (*Montana Sta. Bul. 19, pp. 53–90*).—This bulletin contains considerable data on the production and consumption of sugar in the United States and foreign countries; the climate, culture, and soil requirements of sugar beets; cost of growing in Montana, etc.; analytical data for sugar beets in Montana for each year from 1895 to 1898, with notes on the samples; and analyses of experiment station farm soil, and one sample of limestone. In 1898 the juice of the beets grown had a sugar content of 15.9 per cent, with a purity coefficient of 81.2. "Montana conditions are favorable to the production of sugar beets of high sugar content and standard purity. . . . Our experience, coupled with the results of cooperative experiments by farmers in all parts of the State, lead us to believe that we are justified in expecting yields of from 12 tons an acre upward."

Importance of the right amount and the right distribution of water in crop production, F. H. KING (*Wisconsin Sta. Rpt. 1898, pp. 117–122*).—Studies begun in 1888 on the yield of crops grown with natural rainfall, supplemented by irrigation water, were continued in 1898 (E. S. R., 10, p. 746). The rainfall of the growing season, from April 9 to August 30, was 18.63 in. This was considerably higher than usual, and its distribution was such as to permit the production of nearly maximum yields. "In many parts of the State second crops of hay have been cut which were nearly or quite as heavy as good first crops usually are."

Hay.—The yields of different cuttings of clover, oat, and alfalfa hays are given. The first crops of clover were produced by the natural rainfall, after which irrigation was practiced, but the amount of water applied is not stated. The average yield of clover on 2 plats at the first cutting was 2.58 tons, second cutting 1.45 tons, and third cutting 0.89 ton per acre. "A second crop of nearly a ton per acre could have been secured had no water been applied, but the third crop was made possible only by irrigation." Another feature of the experiment with hays was the spring seeding of 2 plats of oats to clover and alfalfa, respectively. The oats were cut for hay July 6. Three days later the plats were irrigated to force the alfalfa and clover. Three later irrigations followed. Both plats were cut for hay September 15. The alfalfa plat yielded 1.37 tons and the clover plat 2.19 tons of hay per acre. "It appears clear, therefore, that with plenty of moisture in the soil it is possible to seed ground to clover or alfalfa with oats or barley and cut the same season from 1½ to 2 tons of hay per acre from the same ground as a second crop."

Corn.—The yield of corn grown on plats which had been cropped with corn for 5 years in succession without fertilizers was at the average rate of 7,500 lbs. per acre with a natural rainfall of 11.02 in. and 7,106 lbs. per acre where 5.7 in. additional irrigation water was applied. These results, taken in connection with similar results obtained the previous year, suggest "that the fertility of the irrigated ground is being seriously impaired." In another test corn was grown in hills 30 in. apart each way; 4 kernels were placed in each hill on some plats and 2 in each hill on other plats. The thicker seeding received a double amount of irrigation water. With Pride of the North corn the yield of dry matter was at the rate of 7,908 lbs. per acre when 2 stalks in a hill were grown and at the rate of 10,015 lbs. where 4 stalks were grown. Better yields were obtained with a variety of White Dent, but the difference in increase of the thicker seeding was about the same.

Potatoes.—The potato plats in 1898 were divided into alternate subplats of 7 irrigated and 7 nonirrigated rows each. One row was left between each subplat and was irrigated only on one side. The lower ends of the plats were so flat that after one of the heaviest rains the water covered a large part of the ground, and in one instance this portion of the ground was left unirrigated. The total yield from the irrigated subplats of potatoes was at the average rate of 198.9 bu. per acre; of the half irrigated subplats, 192.2; and of the nonirrigated subplats, 182.7 bu. These results, taken in connection with those of previous years, seem to establish the fact that potatoes as well as hay in Wisconsin are benefited by irrigation, even in years of copious and well-distributed rainfall.

Catch crops, W. P. BROOKS (*Massachusetts State Bd. Agr. Rpt. 1898, pp. 316–338*).—This popular lecture treats of the selection of catch crops, the value and methods of green manuring, and the adaptations of various crops for this purpose. Experimental data on variety tests of millets (E. S. R., 9, p. 341) and on the value of green manuring are tabulated and discussed.

Fall cover crops—their efficiency as green manure, P. P. DEHÉRAIN (*Prog. Agr. et Vit., 16 (1899), No. 41, pp. 428–431*).—Data on yields of potatoes and beets following a crop of winter vetch seeded in the fall on a wheat stubble field are given and discussed.

A new textile plant (*U. S. Consular Rpts., 1899, No. 229, p. 330*).—A brief description is given of a natural plant (*Apocynum venetum* or *A. sibericum*), the fiber of which is used in making cord, fish nets, etc. The plant is native to Japan and Siberia.

Some special cultures in Chile (*Mitt. Deut. Landw. Gesell., 14 (1899), No. 16, pp. 94–96*).—Some statistics are given of the fruit, tobacco, and sugar-beet yields and prices in Chile, with 3 analyses of sugar-beet lands.

Report on tests of varieties of cereals made by F. Heine during the year 1899, K. KITTLAUSZ (*Deut. Landw. Presse, 26 (1899), Nos. 78, pp. 889–891; 79, pp. 900, 901*).—Detailed data are given for tests of 11 varieties of rye. The most profitable sort was Heine Green-grain Zeeländer, followed closely by Heine Yellow-grain Zeeländer and Prof. Heinrich. Analyses showed 9.38 per cent albuminoids in Heine Common Zeeländer (old seed), 9.25 per cent in Heine Yellow-grain Zeeländer (new seed), and 10 per cent in Heine Green-grain Zeeländer (new seed).

The culture of barley at Princes Park (*Semaine Agr., 19 (1899), No. 960, pp. 325, 326*).—Data for fertilizer tests with phosphatic fertilizers of different origin on 3 varieties of 2-rowed barley grown on poor soil.

Valuation and culture of barley for brewing (*Deut. Landw. Presse, 26 (1899), Nos. 75, p. 856; 76, p. 864*).

Groninger winter barley, J. H. MANSHOLT (*Deut. Landw. Presse, 26 (1899), No. 62, p. 711, fig. 1*).—A note describing the variety.

Southern forage plants, F. LAMSON-SCRIBNER (*U. S. Dept. Agr., Farmers' Bul. 102, pp. 47, figs. 14*).—This bulletin contains popular information on the formation and care of pastures, as the preparation of the land, time of sowing, and application of fertilizers; and on soiling and fodder crops; and a discussion of the nature, value, and cultural requirements of the more valuable forage plants for the South, including 25 hay and pasture plants, 17 leguminous forage plants, and 6 miscellaneous crops.

"With reference to the selection of forage plants adapted to different regions, the soils of the South Atlantic and Gulf States may be classified as follows: (1) Yellow loam soils; (2) alluvial and river bottom soils; (3) black prairie soils; (4) pine woods soils.

"The forage plants most successfully grown for different purposes on these soils are enumerated below:

"*Forage plants for yellow loam soils.*—For permanent meadows on rich land, Bermuda grass; for a hay crop to occupy rich land 2 years, red clover; for a single hay crop on fair soils, cowpeas; on poor soils, lespedeza. For permanent pastures, Bermuda grass and lespedeza, to which may be added on dry soils, orchard grass, smooth brome grass, and bur clover; on wet soils the addition should consist of redtop, water grass, and alsike clover. Crimson clover, rescue grass, Terrell grass, and hairy vetch are recommended for winter pasture.

"*Forage plants for the alluvial and river bottom soils.*—For permanent meadows, Bermuda grass and red clover; on wet spots, redtop; and on well-drained soils, alfalfa. For a hay crop for a single season, lespedeza or German millet. For pastures, Bermuda grass, lespedeza, redtop, alsike clover, bur clover, alfalfa, Japanese rye grass, large water grass, and Terrell grass.

"*Forage plants for the black prairie soils.*—For hay, Bermuda grass, red clover, and sweet clover. For a hay crop for a single season, lespedeza. For a catch crop, following oats, potatoes, etc., cowpeas or German millet. For pastures, Bermuda grass, lespedeza, sweet clover, alsike clover, smooth brome grass, orchard grass, redtop, bur clover, and hairy vetch.

"*Forage plants for the pine woods soils.*—For hay, Bermuda grass, crab grass, Mexican clover, alfalfa, crimson clover, and lespedeza. For pastures, crimson clover, Japanese rye grass, orchard grass, carpet grass, and large water grass."

Grasses and other forage crops, C. S. PHELPS (*Massachusetts State Bd. Agr. Rpt. 1898, pp. 184-217*).—A lecture delivered at a meeting of the Massachusetts State board of agriculture. Popular descriptions are given of a number of common grasses and legumes, and methods of culture for each are recommended. In this connection the results of field experiments to determine the effect of nitrogenous fertilizers on the yield and composition of corn, oats, and mixed grasses are reviewed (E. S. R., 2, pp. 200, 396).

The hop, from a botanical, agricultural, technical, and commercial standpoint, E. GROSS (*Der Hopfen in botanischer, landwirtschaftlicher, und technischer Beziehung sowie als Handelswaare. Vienna: Gerold's Son, 1899, pp. VII + 255, figs. 78*).

Millets, T. A. WILLIAMS (*U. S. Dept. Agr., Farmers' Bul. 101, pp. 28, figs. 6*).—Reprinted from the Yearbook for 1898 (E. S. R., 11, p. 443). Data showing the average chemical composition and digestibility of the different varieties of millets have been added.

Experiments on the culture of oats in Princes Park (*Semaine Agr., 19 (1899), No. 957, pp. 302, 303*).—Results of tests with phosphatic fertilizers on oats for the years 1895 and 1899. The data given show the kind of fertilizer used, yield of straw and grain per hectare, and profits realized on the different plats. The best results were secured on the plat fertilized with superphosphate. The amount of fertilizer applied per hectare is not recorded.

Experiments in the culture of oats, E. MARRE (*Prog. Agr. et Vit. (Éd. L'Est), 20 (1899), No. 40, pp. 395–398*).—Data as to soil, manures used, dates of seeding, germination, and harvest, and the yield of grain and straw are given for a number of cooperative comparative tests with 7 varieties of oats. The Gray Houdon oats gave the best results as regards yields of both grain and straw.

Belgian black oats, DECAMPINE (*Belg. Hort. et Agr., 11 (1899), No. 5, pp. 70, 71; Landbouwblad Limburg, 1899, p. 115*).

The most profitable method of fertilizing rye following potatoes, M. FISCHER (*Fühling's Landw. Ztg., 48 (1899), No. 19, pp. 736–741*).—Data and a discussion of fertilizer experiments with rye following a crop of potatoes are given. The following conclusions are reached: Nitrogen fertilizers should always be added to rye following a crop of potatoes. These fertilizers should be applied in the fall. Sulphate of ammonia is the most suitable form of nitrogen for this purpose. If fertilizers are used in the spring the best results will be secured with nitrate of soda applied at 2 different times. Superphosphate was used at a loss in these experiments.

Monstrosities in rye, W. RIMPAU (*Deut. Landw. Presse, 26 (1899), Nos. 77, pp. 878, 879, 881, figs. 4; 79, p. 901, figs. 2*).

Phosphoric fertilizers in sugar-beet cultivation (*Sugar Beet, 20 (1899), No. 10, pp. 138, 139*).—Summarization of some experiments with furnace slag and superphosphate carried out in France, in which the best results as regards sugar content and percentage purity were obtained by the use of furnace slag.

What the experiment stations have learned about raising and curing tobacco, E. H. JENKINS (*Massachusetts State Bd. Agr. Rpt. 1898, pp. 18–50*).—A lecture delivered before the Massachusetts State board of agriculture in 1898. Tobacco soils are discussed and a complete review of the experiments with tobacco carried on at the Connecticut State Station for 5 years is given (E. S. R., 10, p. 240).

The best varieties of wheat, J. S. GORDON (*Farmers' Gaz., 58 (1899), No. 43, p. 930*).—Summarized results of test of 15 varieties. The varieties giving the largest yields were Scholey Squarehead Red, 58¼ bu. of grain and 2 tons 18 cwt. of straw; Webb New Standup, 61 bu. 13 lbs. of grain and 2 tons 6 cwt. of straw; and Carter Sunbrown, 50⅝ bu. of grain and 2 tons 13 cwt. of straw. These 3 varieties also produced the strongest and best standing straw.

Fall plowing pro and con, W. C. LATTA ET AL. (*Farmers' Voice, 12 (1899), No. 43, pp. 1228, 1229*).—Opinions of the authors on this subject.

French plowing with a steam plow (*Fühling's Landw. Ztg., 48 (1899), No. 17, pp. 653–657*).—Discussion of the desirable features of steam plowing, with notes on the cost.

Beet puller and topper, E. PAHER (*Jour. Agr. Prat., 1899, II, No. 41, pp. 529–532, fig. 1*).—A description is given of the machine which tops, pulls, and cleans beets, with an account of 3 trial tests in harvesting beets grown in 3 different kinds of soil. In humid sandy soil an average of 1 beet in 20 was irregularly topped and 1 in 200 was not pulled. The beets were well cleaned. Data are not given for the other tests. About 1.8 acres per day were harvested with this machine.

Tests of potato-harvesting machines (*Deut. Landw. Presse, 26 (1899), No. 79, p. 904*).—Data for tests of 11 potato-harvesting machines representing 8 different manufacturers.

HORTICULTURE.

Cold vs. warm water for plants, F. CRANEFIELD (*Wisconsin Sta. Rpt. 1898, pp. 250–268, figs. 4, pls. 2*).—This is a report on experiments in continuation of those begun in 1897 (E. S. R., 10, p. 775). Tests were made to determine the comparative influence of warm and cold water on plant growth. Tomatoes grown under glass were divided into 3 lots and watered with water at 32 to 36, 60, and 90° F., respectively. A record of the soil temperature showed that where the coldest water was used the soil suddenly dropped 15° in temperature and after 12 hours had not regained its original temperature. Water at 60° only slightly affected the temperature of the soil, while water at 90° increased it 6°, but it soon fell to a trifle below the original temperature. The 32° lot was the earliest and produced the largest number and greatest weight of fruit.

This experiment was repeated. Ten plants grown from seeds saved from the 32° lot in the first experiment were watered with water at 32°, 5 plants from the 60° lot with water at 70°, and 5 plants from the 90° lot with water at 100°. "In this case the 100° lot yielded the largest amount of fruit and the 32° lot was next in order, while the 70° lot yielded the least; but the difference is so slight that the results may be considered duplicates."

A crop of radishes was grown at the same time as the first crop of tomatoes and in the same house, separate plats being watered with water at 32, 45, and 70°. The 32° lot gave the poorest yields and the 70° lot the best.

Trials were also conducted with beans in benches, tomato plants in boxes and on raised bench, beans and radishes in wooden boxes, lettuce, and coleus cuttings. They were watered with water at 32, 40, 70, and 100° (beans and radishes in boxes, 110°). The beans in benches gave the largest yields from the 32 and 40° lots. The tomato plants in pots showed no effect that could be ascribed to the temperature of the water used, no difference as shown by the thermometer being apparent after 3 hours. In the case of the tomatoes on raised bench the 32° lot yielded more than the 70° lot, but less than the 100° lot. Lettuce showed a slight gain in favor of the 32° lot, but the weights varied so little that they might be taken as duplicates. The experiments with beans in boxes indicated that the warmer the water the less favorable it was to their growth. The largest yield of radishes in boxes was obtained from the 32° lot. With coleus cuttings the 100° lot at first showed a slight advantage, but later little, if any, influence could be ascribed to the temperature of the water.

The temperature of the soil about the roots was but slightly affected by the varying temperatures of the water applied. While the application of warm or cold water perceptibly raised or lowered the soil temperature for a time, it soon regained its original temperature. In order to observe the effect on growth when the temperature was maintained for a considerable time above or below the normal, 4 lots of water cultures of beans were grown in Sachs's nutrient solution. The temperatures of the water, which was changed daily, were 32, 40, 70, and 100°, respectively, when put in the jars, but gradually rose or fell to the temperature of the room.

The water cultures required more time than the soil cultures to regain their original temperatures. By weighing the various plants it was ascertained that the coldest solution checked the growth of the plants after the first 10 days, but those in the 40° lot made a greater gain than those in the 100° lot.

Experiments with tomatoes were also made under outdoor conditions. Half-barrel tubs of rich soil sunk into the ground were divided into 2 lots, one lot being watered with ice-water, the other from an irrigation system where the average temperature was about 75°. Drainage was good. In the tubs watered with the colder water the temperature was lowered only 5°, yet 28 hours elapsed before the normal temperature was regained. Up to October 3 the plants watered with ice water produced a greater weight of fruit and plants than those watered with warm water. The difference, however, was less marked during the first half of the ripening period than the second. The first half of the summer there was no apparent difference in health and vigor between the plants of the 2 lots, but during the latter half, when the weather had become cooler and the period of most vigorous growth had passed, the plants watered with cold water appeared unhealthy.

A plat of radishes and beans was divided into 3 equal sections, one of which was irrigated during the season with ice water, one with hydrant water, and the third not irrigated at all. The radishes watered with ice water exceeded in weight the ones watered with warm water by about 8 per cent, while those not irrigated at all weighed 18.6 per cent less than those watered with ice water. The rainfall during the season was regarded as nearly or quite sufficient for the development of crops well cared for. The beans showed little difference attributable to the temperature of the irrigation water.

"From the results of these and numerous other trials not here noted the conclusion appears fully warrantable that the growth of ordinary field and garden crops is not affected by the temperature of any water ordinarily available for irrigation purposes.

"The temperature of the soil about the roots of the plants so quickly regains its original temperature that no check to growth is likely to result.

"It is concluded from the results of the outdoor work that no harm can result from using for irrigation purposes water from the coldest springs or wells, for in Wisconsin the temperature of the water from these sources will not be less than 40° in any case when taken from the well or spring and by the means ordinarily employed in irrigation would be raised many degrees above this point before reaching the roots of the plants.

"It is concluded from the results of the greenhouse work that for vegetable and flowering plants commonly grown under glass well or spring water may be freely used at any time of the year without warming."

Fertilizers for garden crops, W. P. BROOKS and H. M. THOMSON (*Massachusetts Hatch Sta. Rpt. 1898, pp. 65-76*).—This is a continuation of work already reported (E. S. R., 10, p. 636). As heretofore, fertilizers were applied to the experimental plats in the form of sulphate of ammonia, muriate of potash, dissolved boneblack, nitrate of soda, dried blood, and sulphate of potash, at the rate of 50.4 lbs. of phosphoric acid, 60 lbs. of nitrogen, and 120 lbs. of potash per acre; but in addition, barnyard manure was also applied to each of these plats at the rate of 12 cords per acre, and a check plat received no other fertilizer except the same amount of barnyard manure. The growth of Clyde strawberries was vigorous and healthly on all plats. Hanson lettuce did best on barnyard manure. Long-standing spinach and Dewing Blood Turnip beet did slightly better on sulphate of potash than muriate of potash. All three were seriously injured by sulphate of ammonia, especially when combined with muriate of potash. Nitrate of soda showed much superiority as a source of nitrogen for both spinach and beets.

The results on tomatoes were similar, but the differences were less marked. Sulphate of ammonia did not, however, appear to affect this crop unfavorably. This is attributed to the fact that tomatoes make most of their growth when the season is well advanced, while spinach and beets make theirs early in the season.

Artificial fertilizers apparently produced a moderate increase in crops of Fottler Drumhead cabbage and Early Maine potatoes. Nitrate of soda appeared to be the best source of nitrogen for cabbage. Sulphate of potash was superior to muriate for potatoes. Sulphate of ammonia was by far the best source of nitrogen, followed in order by nitrate of soda and dried blood. The combination of sulphate of ammonia with muriate of potash, which has generally proved fatal to most crops, gave a fine crop of potatoes. The explanation suggested is the same as in the case of tomatoes. "It seems reasonable to suppose that, as the season advances, the injurious ammonium chlorid formed at first is either washed out of the soil or destroyed by further chemical changes." The results with Giant Pascal celery are to be published later. Spinach, lettuce, and beets were followed by White Egg turnips without further manuring. The artificial fertilizers were moderately beneficial. Sulphate of ammonia appeared to be the best source of nitrogen. "This is not strange, in view of these facts: (1) The plats to which this had been applied had produced but very small first crops, while the others had yielded heavily; and (2) the turnips made their growth so late in the season that the injurious compounds often formed by this salt had become dissipated or destroyed by further chemical changes."

Report of the horticulturist, S. T. MAYNARD (*Massachusetts Hatch Sta. Rpt. 1898, pp. 11–19*).—Notes are given on a number of varieties of fruits recently tested at the station. The author believes that the older varieties of apples are growing more and more feeble and that new varieties are needed to replace them. The case of the Baldwin apple is cited. This variety "has in many places in the last 2 or 3 years shown so great a tendency to the dry-rot spots under the skin long before its normal time for the breaking down of its tissues in the process of ripening that much of its fruit put on the market has had the effect of decreasing the demand and lowering the price." The following varieties of apples are recommended, and descriptive notes given of them: Sutton Beauty, Palmer, MacIntosh Red, Wealthy, and Gano.

Fewer varieties of pears are found profitable than a few years ago. Those recommended are: Bartlett, Bosc, Sheldon, Seckle, and Hovey.

Plums have shown a great tendency to rot. Those most liable to this malady are: Lombard, Washington, Gueii, Smith Orleans, and Victoria. Those that show the least tendency to rot are Bradshaw, Prince Englebert, Kingston, Grand Duke, Reine Claude, and Fellenberg. Newer varieties of promise are Kingston, Lincoln, and Fellenberg. These varieties are described.

Cherries rotted badly on account of extremely hot and moist weather at the time of ripening. This trouble may be successfully combated by thoroughly spraying immediately after each rain. Varieties most resistant to the rot are Governor Wood, Napoleon, Black Tartarian, and Early Richmond.

Recommended varieties of grapes for Massachusetts are Winchell or Green Mountain, Worden, and Delaware. Campbell Early is mentioned as a new variety of promise, and is described.

Meritorious new varieties of currants are Pomona, Wilder, and Red Cross. None, however, of the newer varieties of currants, blackberries, and red raspberries have surpassed the old standard sorts. Varieties of strawberries that gave best results on medium heavy loam are Brandywine, Gandy Bell, Glen Mary, Sample, and Howard No. 14. Of those grown under field culture on light land, Clyde, Cumberland, Glen Mary, and Howard Nos. 36 and 41 gave best results.

Notes are given on the strawberry-raspberry, and Loganberry.

Revised catalogue of fruits recommended for cultivation in the various sections of the United States and the British Provinces by the American Pomological Society (*U. S. Dept. Agr., Division of Pomology Bul. 8, pp. 63, map 1*).—This catalogue is similar in character, scope, and general plan to its predecessor (E. S. R., 9, p. 648). In this edition the number of fruit districts has been increased from 15 to 19, boundary lines of districts have been changed in some instances to conform to later advices, and the work increased in value by the added data obtained in a special study of the pomological conditions of the Pacific coast region. The data here presented are considered suggestive rather than conclusive for the different districts, and planters are cautioned against following them too closely. All of the more important species and varieties of fruits and nuts now grown in the United States and the adjacent British Provinces on the north are considered. The society's rules for exhibiting and naming fruits are given in the concluding chapter of the bulletin.

Morphology of the strawberry plant, E. S. GOFF (*Wisconsin Sta. Rpt. 1898, pp. 229–238, figs. 6*).—A study of the morphology of the strawberry plant, with especial reference to adaptation to environment, and its significance for the culturist. Application is made of the facts ascertained in enabling the author to give a rational explanation of why strawberry beds soon run out, as also of various cultural practices, as those of winter protection, removal or nonremoval of runners, etc. Contrary to the statement in numerous botanies, the author finds that the strawberry is not acaulescent, but has a short, thickened stem.

Grapevine fertilizer experiments, M. WIENER (*Deut. Landw. Presse, 26* (*1899*), *No. 78, pp. 891–893, figs. 10*).—The value of commercial fertilizers as manures for grapevines on sandy and clay soils was studied at the Altenburg Experiment Station in Hungary. One hundred and fifty sheet-metal cylinders, 1 meter long by 60 cm. in diameter and open at both ends, were sunk in the ground in 1894. Underneath the cylinder a layer of gravel 25 cm. in thickness was spread. Seventy-five cylinders were then filled with poor sand and 75 with clay soil containing lime. In the spring of 1895 a vine was set in each cylinder. Pots 2 to 18, which had been filled with sandy soil, received certain amounts, either alone or in different combinations, of superphosphate, nitrate of soda, sulphate of potash, and sulphate of ammonia, the purpose being to study the effect of relatively large amounts of fertilizers. Pots 19 to 36 were planned to test the effect of half the amount of the same fertilizers; pots 37 to 54, the effect of increasing or decreasing each of the essential elements in a complete formula; pots 55 to 57 and 59 to 69 to determine what amounts of chemically pure phosphoric acid, potash, and nitrogen fertilizers are necessary for the production of a full yield on a poor sandy soil; and pots 70 to 75 to determine the effect of phosphatic fertilizers when combined with organic nitrogen (night soil). Pots 1 and 58 were used as checks and received no fertilizers. The same fertilizers were applied in duplicate to the 75 pots filled with clay soil.

The results obtained during the 4 years of the experiment are discussed and the growth obtained in a number of pots is illustrated by photographs. The different effect of the same fertilizers on the two soils was very noticeable. On the clay soil the fertilizers had practically no observable effect, the harvest of grapes and the development of the vines being as good in the unfertilized pots as in those receiving fertilizers. In general the growth of the vines in the clay pots was much stronger than in the sand pots, but the yield was considerably less. The yield from vines in the pots filled with sand which received complete fertilizers averaged more than 1,000 gm. per vine, and in one instance was 3,182 gm., while the highest yield obtained from any vine in the clay soil was only 1,120 gm. and the yield from the others in the clay series was less than 1,000 gm. per vine. The effect of the complete fertilizers on the sandy soil was apparent to the eye and the results were such as to lead to the belief that a full yield of grapes can be obtained on sandy soil by the use of complete commercial fertilizers without resort to barnyard manures. The omission of one of the essential elements in a complete formula had a harmful effect on the development of the vine in the pots filled with sand, though the growth when only one element was employed was always greater than when no fertilizer was used. The poorest results in this series were obtained in the pots receiving nitrogen and potash alone, followed by the pots which had received only phosphoric acid. No difference was noticeable as to the growth and yield of pots 2 to 18, which received relatively large amounts of fertilizers, and pots 19 to 36, which received half the same amounts. The chemically pure fertilizers, while giving good results, proved too costly for general use. Night soil with phosphoric acid gave results practically identical with those obtained from phosphoric acid alone. It is believed, therefore, that the nitrogen requirements of grapes are slight and that good harvests can be obtained with potash and phosphoric acid fertilizers alone, even on soils poor in nitrogen.

The cultivation of monstrosities, H. DE VRIES (*Compt. Rend. Acad. Sci. Paris, 128 (1899), No. 2, pp. 125-127; Gard. Chron., 3. ser., 25 (1899), No. 633, p. 88*).—For about 12 years the author has cultivated vegetable monstrosities with a view to studying their abnormalities. With the exception of virescence caused by parasites, they have proved to be hereditary and have produced by isolation and selection races of varying degrees of persistence. Some monstrosities show no greater tendency to revert than do ordinary varieties of cultivated plants, while others reproduce only one-third or one-fourth of the individuals true to type; but those plants that do revert to the normal type preserve certain characteristics of abnormality, though in different degrees. Often the anomalous structure is reproduced at the top of the stem or in the lateral branches. In perennials the abnormal forms have reappeared after 3 or 4 years. Sometimes plants appear to be absolutely normal but yet retain the ability to reproduce an ancestral abnormality in their seed. The less the fixity of the type, the more is its preservation dependent on environment; hence the necessity for careful cultivation. Monstrous varieties even in wild species require more careful culture than the most variable ornamental plants. Thorough cultivation is necessary, especially during the periods of germination and early growth. Monstrosities must have plenty of room.

From the standpoint of physiology, monstrosities may be classed as constant, precocious, or tardy. Constant monstrosities show no greater tendency to revert than common varieties and require the same culture. Precocious monstrosities are those that appear in very young plants. Tardy monstrosities are those that appear only after several weeks or months.

The development of monstrosities depends primarily on the vigor of the individual plant, especially in the early stages of growth. Selection of seed producers is of only secondary importance. Monstrosities require a sunny and healthful situation and plenty of manure. Annuals produce a larger proportion of abnormal forms if the seed is sown early and the young plants have abundant warmth and light. In biennials the number of fasciations and tortuous growths and their development are in proportion to the length and vigor to which the rosettes of radical leaves attain before the development of the stem. If very heavily manured, biennials winterkill. Species optionally annual or biennial are most variable. They form good fasciations only on biennial plants.

Why crops must have nitrogen and how it can be provided, G. C. CALDWELL (*Trans. Massachusetts Hort. Soc. 1899, I, pp. 56-74*).—A paper read by the author before the February meeting of the society in which the discovery of root tubercles and the use of leguminous plants and Nitragin in agriculture are considered at length.

Commercial fruit and vegetable culture in Australasia (*Gartenflora, 48 (1899), No. 17, pp. 466-468*).—Statistics of the fruit and vegetable production and of the imports and exports of the same for the different provinces of Australasia.

Watering plants in fields, F. CRANEFIELD (*Gardening, 8 (1899), No. 169, pp. 9, 10, figs. 3*).—Suggestions for irrigating gardens.

The culture of asparagus, L. PASSY (*Bul. Soc. Nat. Agr. France, 59 (1899), No. 4, pp. 249-288*).—This includes a discussion by de Vilmorin, de Salvandy, and Rolland.

Ginseng: Its cultivation, harvesting, marketing, and market value; with a short account of its history and botany, M. G. KAINS (*New York: Orange Judd Co., 1899, pp. 64, figs. 13*).

Catalogue of fruits for the use of planters, L. WOOLVERTON (*Ontario Fruit Expt. Stas. Rpt. 1898, pp. 177-192*).—Catalogue for the use of planters, showing values of the orchard and small fruits of Ontario and of their adaptability to different parts of the Province.

✓ **Fruits of Ontario,** L. WOOLVERTON (*Ontario Fruit Expt. Stas. Rpt. 1898, pp. 3-95, figs. 163*).—Descriptions, notes on the origin, character, and adaptability to Ontario, and natural size illustrations of 23 varieties of apples, 21 of cherries, 4 of currants, 9 of gooseberries, 2 of grapes, 18 of pears, 3 of peaches, 40 of strawberries, and 2 of quinces which have been successfully grown in the Province. The object of the work is to present an historical record of the size, color, general appearance, and real value of all fruits grown in the Province as a means of identification.

Fruit experiment stations of Ontario (*Ontario Fruit Expt. Stas. Rpt. 1898, pp. 97-175, figs. 2*).—Reports from some 15 fruit stations in the Province relative to culture experiments and variety tests, with descriptive notes on a large number of the fruits tested, and notes on the official inspection of the same stations. The comparative results obtained in certain pruning and spraying experiments and the selling price in 1898 of apples, pears, blackberries, raspberries, currants, grapes, and strawberries are also noted.

Observations on Russian fruits at the Central Experimental Farm, 1898, W. T. MACOUN (*Ontario Fruit Growers' Assoc. Rpt. 1898, pp. 10-14*).—Notes are given on a number of varieties of apples, pears, plums, and cherries.

New and seedling fruits, H. L. HUTT (*Ontario Fruit Growers' Assoc. Rpt. 1898, pp. 58-62*).—Notes on a number of new varieties of seedling apples, pears, plums, peaches, grapes, and cherries.

Promising new fruits, C. P. TAFT (*Pacific Rural Press, 58 (1899), No. 16, p. 244*).—The present status of the loquat and Loganberry are given, with suggestions as to cultural methods, and notes on miscellaneous small fruits.

Manitoba and the Northwest Territories as markets for Ontario and British Columbia fruit, W. SAUNDERS (*Ontario Fruit Growers' Assoc. Rpt. 1898, pp. 39-48*).—Includes notes on the very limited native fruits of the region.

Export of fruit pulp, J. W. ROBERTSON (*Ontario Fruit Growers' Assoc. Rpt. 1898, pp. 18, 19*).—It is believed that the export of fruit pulp to Great Britain is not profitable except in those cases in which the grower finds a surplus of unsalable fruit on hand.

Central Experimental Farm notes, I, W. T. MACOUN (*Canad. Hort., 22 (1899), No. 10, pp. 396, 397*).—Brief notes on apples, plums, grapes, and hardy shrubs at the Central Experimental Farms.

Seaweed for fruit borders, R. PARKER (*Garden, 56 (1899), No. 1457, p. 311*).—The substitution of seaweed for barnyard manure as a mulch for orchard fruits, vines, etc., is considered. Seaweed is considered especially valuable in dry seasons on light soils, because of its superior moisture-holding properties.

Protecting nursery stock in winter, N. H. ALBAUGH (*Florists' Exchange, 11 (1899), No. 43, p. 1081*).—Instead of the usual method of healing in nursery stock, the author recommends that it be corded up in a storage house. The roots should be packed with slightly damp moss, and where the building is very large one or two stoves is advised for use during the coldest weather. The details of packing and arranging the trees in the storehouse are given.

Whole versus piece roots (*California Fruit Grower, 24 (1899), No. 593, p. 5*).—In a test of whole *vs.* piece roots for grafting apples, whole roots were found the best for slow-growing sorts. Grafting 2 in. above the crown is advised.

The Cadillac graft, M. CAPUS (*Semaine Agr., 19 (1899), No. 957, pp. 299, 300*).—The Cadillac system of grafting is described and some results secured in a number of grafts in different species of grapes noted.

Fruit-tree pruning, G. QUINN (*Jour. Agr. and Ind., South Australia, 3 (1899), No. 2, pp. 116–139, pls. 32*).—Right methods of pruning apples, pears, and quinces are illustrated by numerous photographs and the process described.

Obtaining dwarf plants by means of cuttings (*Rev. Hort., 71 (1899), No. 17, p. 413*).—The author states that cuttings taken from the extremities of branches of plants which have reached complete development but have not produced flowers will take root under proper conditions and produce flowers without much further growth. If the plants to be dwarfed produce both terminal and axillary flowers, the cuttings should be taken from the least developed flower branches. The cutting should be made from 5 to 7 cm under a node in each case. Chrysanthemums, asters, roses, and several greenhouse plants have been thus dwarfed.

The grafting of coffee, cacao, and nutmeg trees, A. THIERRY (*Abs. in Rev. Cult. Coloniales, 5 (1889), No. 38, pp. 201–209*).—The relative values of different methods of grafting these trees are discussed.

Instructions as to seed time, culture, and profits of cacao (*Bol. Agr. Min. e Ind., 8 (1898), No. 5; abs. in Agricultor [Bogota], 15. ser., 26 (1899), No. 6, pp. 257–265*).—A discussion of suitable soils, nursery management, cultivation, harvesting, and profits in cacao culture.

Cacao culture in Ecuador (*U. S. Consular Rpts., 1899, No. 229, pp. 250–261*).—This article deals with the soil, methods of planting and cultivation, harvesting, marketing, cost of production, consumption, uses and botany of cacao as grown in Ecuador, with a table showing analyses of cacao from 4 countries.

The diœcism of the fig in its bearing upon caprification, W. T. SWINGLE (*Science, n. ser., 10 (1899), No. 251, pp. 570–574*).—Paper on this subject read by the author at a meeting of the American Association for the Advancement of Science at Columbus.

Zante currant in South Australia, F. C. SMITH (*California Fruit Grower, 24 (1899), No. 588, p. 3*).—Notes on the character, growth, and profits derived from the culture of this fruit in South Australia.

The tea industry (*Agr. Jour. [Natal], 2 (1899), Nos. 10, p. 305, figs. 2; 11, pp. 340, 342, fig. 1; 12, pp. 371–373, fig. 1*).—Notes on the history of tea with an account of cultural methods on the Kearsney estate and chemical analyses of 5 samples.

The mulberry, its culture and treatment, N. SHAVROV (*St. Petersburg: A. F. Devrien, 1899, 2. ed., pp. X + 200, figs. 142; abs. in Selsk. Khoz. i Lyesov., 194 (1899), July, p. 186*).—This book contains an account of the distribution of the mulberry in Russia, and general directions for its cultivation with special reference to silkworm culture.

Intensive fertilizing of vines, L. DEGRULLY (*Prog. Agr. et Vit., 16* (*1899*), *Nos. 40, pp. 381-388; 41, pp. 409-411*).—The amount of fertilizers applied in different provinces of France for the production of a hectoliter of wine and the amount of fertilizers taken up by the vines in the production of the same are tabulated and discussed. Data showing the value of fertilizing vines with all 3 essential elements are also given.

Packing vine cuttings, C. RIVIERE (*Rev. Cult. Coloniales, 5* (*1899*), *No. 3, pp. 198-201*).—Directions for packing vine cuttings for shipping in warm climates.

Some effects of the freeze of 1898-99 in Iowa, J. CRAIG (*Amer. Gard., 20* (*1899*), *No. 252, pp. 720, 721*).—A paper read by the author before the American Pomological Society at its meeting in Philadelphia. A general discussion is given of the subject, with a brief account of experiments in pruning and banking root-injured nursery stock. With apples the best results, 20 per cent of treated trees, were obtained when all the branches, including the leader, were cut back one-half. Ninety-five per cent of plums on native stock lived when the side shoots were cut back to the main stem and the leader left. Banking apples or pears was of no practical benefit, but with grapes 80 per cent were saved by cutting back severely and hilling deeply.

A new packing material for fruits (*Gard. Chron., 3. ser., 26* (*1899*), *No. 666, pp. 258, 259*).—A preparation of asbestus is reported to have kept apples shipped from Australia 5 months in perfect condition.

Crystallized and glacéd fruit (*California Fruit Grower, 24* (*1899*), *No. 587, p. 1*).—A statement of the method of preserving fruit in the crystallized, or glacéd, form known as the French process.

Preservatives for bottled fruits (*Canad. Hort., 22* (*1899*), *No. 8, pp. 326, 327*).—General directions for preserving exhibition fruit and formulas for a number of kinds.

Chestnut culture, J. B. EMERSON (*Virginia Hort. Soc. Rpt. 1898-99, pp. 93-99*).

A chapter on walnuts, HARRIS (*Florists' Exchange, 11* (*1899*), *No. 42, pp. 1056, 1057*).—Varieties *Juglans nigra*, *J. cineria*, *J. regia*, *J. cordiformis*, and *J. sieboldi* are described and suggestions given regarding their culture.

A new plant, O. AMES (*Amer. Gard., 20* (*1899*), *No. 248, p. 654*).—A desirable new hybrid orchid originated by W. Turner by crossing Selenipedium with Geralda is noted and measurements showing the lengths of the petals, dorsal sepals, and ovaries as compared with several other varieties and hybrids of Selenipedium are given. A technical description is given of the hybrid, together with a list of hybrids having *S. lindleyanum* as one parent.

Bamboo culture (*Agr. Jour. Cape Good Hope, 15* (*1899*), *No. 1, pp. 42-44*).—A popular article describing bamboo culture as it is carried on in southern Africa.

Clianthus dampreri, E. ANDRÉ (*Rev. Hort., 71* (*1899*), *No. 17, pp. 409, 410, fig. 1*).—The difficulty usually attendant in the culture of this plant has been overcome in part by grafting on a resistant subject, as *Colutea frutescens*. The grafting is performed by substitution of the plumule of the graft for that of the stock as soon as the cotyledons of the stock have opened.

Dillenia speciosa, L. A. BERNAYS (*Queensland Agr. Jour., 4* (*1899*), *No. 6, pp. 457, pl. 1*).—This fruit is noted as successfully growing in the garden of the Acclimatization Society. It is a native of India and the Malayan Islands, where it is found in dense forests. The trees attain a height of 40 ft. and are evergreen. The fruit is 3 to 4 in. in diameter and when fully ripe has an agreeable acid taste when eaten raw, cooked in curries, or made into sherbet. A glutinous matter which surrounds the seeds is used for making a palatable jelly, a cough mixture, or a cooling drink in fevers and otherwise. The bark and leaves are astringent and are used medicinally. The timber is valuable for gunstocks, handles, and such like, and is especially valuable for its durability under water.

Eucharis (*Gard. Chron., 3. ser., 26* (*1899*), *No. 665, pp. 238-240, fig. 1*).—Descriptive notes on 10 varieties with suggestions as to cultivation, forcing, and insect pests and diseases.

Sowing fern spores, A. HEMSLEY (*Garden, 56 (1899), No. 1450, pp. 186, 187*).—Directions for gathering and preserving fern spores, preparing the seed pots, care during early stages of growth, transplanting, watering, and the like are given. Subwatering rather than surface application is insisted upon.

The bush honeysuckle, J. DUNBAR (*Gardening, 8 (1899), No. 169, pp. 2, 3*).—Sixteen varieties of Lonicera are described and their individual values as ornamental shrubs pointed out.

Evergreen protection (*Wallaces' Farmer, 24 (1899), No. 39, p. 795*).—The results of tree planting for wind protection in Iowa are discussed. The Russian mulberry has proved an efficient wind-break planted in rows 10 ft. apart and 2 ft. distant in the row. For permanent groves and wind-breaks the green and the white ash are recommended above all others among deciduous trees and the Riga pines among evergreens.

DISEASES OF PLANTS.

Experimental investigations on some diseases of plants, E. LAURENT (*Ann. Inst. Pasteur, 13 (1899), No. 1, pp. 1–48*).—While studying the effect of large amounts of different fertilizers upon the production of potatoes, the author found that the tubers of one lot that had been grown upon a plat where the soil had received a large quantity of lime were badly attacked by bacteria, resulting in a bacterial rot, while the same varieties, but from other plats, were unaffected. This suggested investigations to ascertain the effect the medium in which plants grow may have in influencing their resistance to disease.

In 1897 several varieties of potatoes were grown in plats which were apparently of equal fertility. The different plats received the following fertilizers per hectare: Plat 1, 1,100 kg. of ammonium sulphate; plat 2, 2,200 kg. of kainit; plat 3, 2,200 kg. of calcium superphosphate, and plat 4, 15,500 kg. of fat lime; plat 5 being left as a check. As in the previous year, some months after harvest the tubers of the less resistant varieties in plat 4 were attacked by a bacterial growth. Upon isolation this proved to be a well-known saprophyte, *Bacillus fluorescens putidus*. Inoculations made upon cut tubers of the other varieties from the different plats failed to grow. Cultures made upon the susceptible variety after a time seemed to develop an increased virulence until all varieties from all plats could be readily infected, the last to yield being those from plat 3, where calcium superphosphate had been added to the soil. In order to secure this virulence, it was found necessary that the cultures should be continued for some time upon raw potatoes, and a single passage through cooked potato or a synthetic medium was sufficient to destroy the parasitism of the germs.

In 1898 8 varieties of potatoes were grown under conditions similar to the above. In this series plat 1 received at the rate of 500 kg. of sodium nitrate and 800 kg. of ammonium nitrate, and plat 4 received 40,000 kg. of lime per hectare, the other plats receiving fertilizers approximately as in the previous years. The tubers were harvested and experiments made with them as before, the organism used this time being *Bacillus coli communis*, and results analogous to the above were obtained. Carrots and chicory were also introduced into the experiments. In general it was found that lime diminished the resistant power of potatoes, carrots, and chicory toward the bacterial rot, while the phosphates increased their resistance. Nitrogenous and phosphatic fertilizers diminished resistance to a slight degree, while sodium chlorid increased it in about the same degree.

Experiments were conducted to ascertain the means by which the potato resisted the attacks of the organism. It was found that the potato owes its resistance to the presence of soluble substances in the cell sap of the tubers. This is destroyed by alkaline solutions and the total acidity of the cell sap does not correspond to the action of this protective substance.

The method by which the bacteria gain entrance into the tubers was studied, and it was found that it was by the intervention of certain unorganized ferments secreted by the organism. These were separated and some of their peculiarities are noted. Experiments indicate that these substances when properly manipulated, render plants resistant to disease, acting in the same way toxins do toward animals.

Experiments are also reported in which are shown the action of fertilizers in increasing or diminishing the resistance of potatoes toward attacks of *Phytophthora infestans.* Nitrogenous fertilizers seem to decrease the resistance of even the most resistant varieties of potatoes to attacks of Phytophthora. Lime also appears to exert a similar effect, but in this case it is indirect, the lime acting through the stimulating effect it has upon nitrification in the soil. The experiments with *Sclerotinia libertiana* reported were mostly made with artichokes, carrots, and chicory. The results obtained are analogous to those for the species of Bacillus reported above. In this case phosphatic fertilizers increased the tendency to disease.

In conclusion, it is shown that under certain conditions saprophytic organisms may develop pathogenic properties. As an essential for this development the natural resistance of the plant must be weakened by the improper use of fertilizers, and the virulence of the attack may be increased by systematic cultures in the living medium, the use of a synthetic medium, or any change in the medium being sufficient to destroy the acquired pathogenic properties. The different effect of the same fertilizers on different plants is explained by the fact that some organisms require an alkaline medium while others need an acid one for their development. Unless the proper conditions are present the diastases formed by the organisms can not dissolve the middle lamella of the cells and gain entrance into the host.

The author claims that in order to preserve cultivated lands from the injurious effects of constantly present micro-organisms, recourse must be had to procedures based upon the influence of fertilizers in promoting the resistance of plants toward their parasites.

Report of the botanists, G. E. STONE and R. E. SMITH (*Massachusetts Hatch Sta. Rpt. 1898, pp. 142–167*).—The principal investigations reported are those which have been conducted in connection with market garden crops such as are cultivated in greenhouses, the principal ones being lettuce, cucumbers, and tomatoes. The experiments which are being conducted, briefly outlined, are investigations of the control of "drop" in lettuce, "top burn," effect of mechanical condition of soil as influencing the growth of lettuce, and subirrigation as affecting lettuce diseases; experiments on the pruning of cucumbers as affecting the maturity and production of fruit, and also the various fungus diseases of this crop; experiments on the pruning of tomatoes, and the tomato diseases; experiments in the growth of violets; the use of gases and chemical solutions for disinfecting greenhouses, and on the relation existing between electricity and plant growth.

Brief reports are given on black spot of the maple (*Rhytisma acerinum*), the oak-leaf blight (*Glœosporium nervisequum*), the walnut-leaf blight (*G. juglandis*), and the leaf curl of the peach (*Exoascus deformans*).

A muskmelon disease is described, which is caused by a species of Alternaria. The presence of the disease is manifest by the wilting of the leaves, the center of the hill being usually the first point of attack. The leaves are covered with yellow spots, and in the worst cases exhibit dead areas of considerable size. When the disease was first noticed it had made considerable advancement, so that but little benefit could be expected from any treatment given it. Sprayings, however, were made with Bordeaux mixture and it is thought that they were followed with favorable results.

The rotting of cabbage in the field, caused by a species of bacteria, is reported as having been observed at the station grounds, and is also known to exist in several places throughout the State. This disease has been fully described (E. S. R., 9, p. 849).

In continuation of investigations previously reported (E. S. R., 10, p. 648), the authors give further information relative to the drop of lettuce due to *Botrytis* sp. It seems probable that this disease is not spread by distribution of the spores through the air, but by a mycelium growth in the soil itself. Experiments have been conducted along different lines to prevent the growth of this mycelium, chemicals and gases being used, and the effect of different layers of sand and sterilized earth are reported. The experiments showed that the heating method is the only absolute way of controlling the disease, although some gain is shown by covering the soil to a depth of about three-fourths of an inch with sand. When the sand was sterilized, better results were obtained than when unsterilized. This method gives promise of being practicable, but the authors are not yet satisfied that it is the cheapest that can be utilized, and other methods are being investigated.

The chrysanthemum rust has been studied to some extent, and the indications are that the disease can be controlled by proper methods of cultivation and management. It is claimed that the high August temperature had an injurious effect upon plants confined in pots, such plants being much more susceptible to disease. The rusted plants, although badly affected, produced blossoms apparently as good both in quality and quantity as the healthy ones, and the disease did not spread to other plants kept in close proximity to them. Judging from the year's experience, it seemed probable that a skillful gardener need have no fears from this disease.

A new pansy disease is described, in which the leaves and blossoms of the plant are badly affected by a fungus. This fungus is apparently undescribed, and the name *Colletotrichum violæ-tricoloris* is given it (E. S. R., 11, p. 257). Many plants were killed outright, and all affected ones were in very poor condition. The affected leaves first showed small dead spots, each surrounded by a definite black border, and the petals were often disfigured in a similar way. In other cases the flowers were malformed or only partly developed. This disease has been observed in a few localities in the State and is also reported from New Jersey. A portion of a diseased field was sprayed twice with strong Bordeaux mixture, but as it was late in the season and heavy rains prevailed at the time, little success was obtained. Some benefit, however, is thought to have followed the use of the fungicide, and it is believed that the disease could probably be kept in check by proper treatment.

A number of physiological disorders of plants are mentioned, among them some seasonal peculiarities of certain shade trees, in which the leaves were dropped early in the season; effect of overfeeding of plants, bronzing of rose leaves, wilt of cucumbers, and some of the difficulties which city shade trees have to contend with.

The bronzing of the rose, which is described at considerable length, is manifest by a mottled discoloration of the leaf, and its cause is of a physiological nature or due to structural weakness. These spots subsequently become more apparent, and infected portions of the leaves turn yellow and finally leaflets and leafstalks fall to the ground. An excessive deposit of calcium oxalate has been observed in the leaf cells, and it is thought that these leaves are more susceptible to fungus diseases than healthy ones. An examination of affected plants at a large conservatory near the station showed that all the leaves of plants were not equally affected, but that it seemed to be confined in every instance to two places: First, where a stem is cut and a new branch starts, the leaf at the base of the branch begins to bronze, and, second, where an eye or axillary bud is rubbed off, the leaf generally becomes bronzed. There is also a difference in susceptibility between young plants and old ones. Roses planted in the middle of June frequently showed bronzing the first of August, but the disease is scarcely noticed after the first year's growth. In conclusion, this disease is said to be a physiological disorder which falls under the domain of plant irritability.

The cucumber wilt, which is described, bears some resemblance to bacterial wilt, but is not due to any organism, being brought about by irrational methods of cultivation which give rise to defective transpiration. The methods for its prevention are apparent.

Bird's-eye of olives, U. BRIZI (*Staz. Sper. Agr. Ital., 32 (1899), No. 4, pp. 329–398, pls. 2*).—An extensive study on the disease of olives due to *Cycloconium oleaginum* is reported. The characteristics of the disease are described and the conditions under which attacks may be expected. An extensive investigation into the life history of the fungus is given and artificial inoculation experiments are reported at some length. A nearly related form of the genus is described under the name *C. oleaginum phillyreæ* as occurring on plants related to the olive.

Experiments are reported in which the disease was prevented by thorough applications of a rather weak Bordeaux mixture. A short bibliography concludes the report.

New studies of the brown rusts of grains and grasses, J. ERIKSSON (*K. Landt. Akad. Handl., 33 (1899), No. 3, pp. 172–206, charts 3*).—The extensive studies on this subject conducted by the author during late years are summarized in this paper, and a full account is given of the latest results obtained. The following conclusions are drawn:

The brown rust of wheat (*Puccinia triticina*) does not originate through infection from any other plant species. Two sources of its origin are possible—infection in the spring from the teleutospores of the fungus then growing, or a disease germ found in the seed grain and transmitted from the parent plant. Of these two sources of disease the latter is, in all probability, the principal one. Fresh brown rusted wheat straw should be avoided in manure which is spread on or near a field that will be sown to wheat the following year.

The brown rust of rye (*Puccinia dispersa*) can grow on the young winter rye plants in the late fall through infection from varieties of bugloss (*Anchusa arvensis* and *A. officinalis*) growing near by, which are affected with rust (*Æcidium anchusæ*); for this reason these weeds should not be allowed to grow in the neighborhood of rye fields. Two other sources of its origin are possible, as with the wheat rust. Rye in rare cases may be attacked by the forms of brown rust found on wheat and couch and brome grasses, but the source of the true brown rust of rye can not be sought in any of these grasses, especially as it is the earliest one of them all. Fresh brown rusted rye straw should be avoided in manure which is spread on or near fields intended for rye.

Puccinia bromina, *P. agropyrina*, *P. holcina*, and *P. triseti* are of little importance to grain raising, as none of them can be considered the source of the brown rust of either the wheat or rye.

In choosing brome grasses for meadows, varieties subject to attack of rust, like *Bromus mollis* and *B. arvensis*, are to be avoided (both these varieties are also particularly susceptible to smut, *Ustilago bromivora*), and such as *B. erectus* and *B. inermis* chosen, which are not only not susceptible to rust, but also give a much heavier yield of forage.—F. W. WOLL.

Club root, or finger-and-toe disease (*Rept. Agr. Expts. Cornwall County Council, 1898, pp. 27–42, pls. 7*).—Experiments are reported upon, in which the infectious nature of the organism causing club root is shown, and warnings are given of the danger of contamination through various means. Various remedies were investigated, from which it appeared that liberal applications of lime or basic slag were very efficient in checking the disease. The relative value of deep and shallow cultivation in connection with the application of lime, slag, etc., was investigated. Where 6 tons of lime per acre were applied and the soil frequently cultivated to a depth of 3 inches, the results were much more favorable than where an occasional cultivation to a depth of one-half inch was given. The total weight of the crop, as well as the increased number of sound roots, were in favor of the deeper cultivation.

Experiments are quoted in which 6 and 8 tons of lime per acre were compared, to the advantage of the latter amount. So far as clean roots were concerned, the proportion from the plats receiving 8 tons per acre was largely in excess of that from the plats receiving 6 tons. The total yield of turnips was practically the same in both cases. Superphosphate and basic slag were compared, indicating that superphosphate is without value as a preventive treatment of club root. The proper time of application of preventive treatments was investigated, June and autumn applications being compared. The superiority of the autumn treatment was quite evident. Copper sulphate as a means of prevention of club root was tried, but proved to be without any value in badly infested soils.

The possibility of infection through the presence of the micro-organism of the disease in the manure of animals fed on turnips is to be a subject for further investigation.

A text-book of plant diseases caused by Cryptogamic parasites, G. MASSEE (*New York: The Macmillan Co., 1899, pp. XII+458, figs. 92*).—The aim of this book is to enable those occupied with the cultivation of plants to determine the nature of diseases due to parasitic plants and in combating them to apply in the most approved manner those treatments which experience has shown to be most successful. A general discussion of parasitic fungi, lichens, algæ, slime molds, and bacteria is given, together with formulas for fungicides and directions for spraying.

The diseases are each briefly, though clearly, described, and preventive measures, where any are known, are given, followed by references to some of the more important literature bearing on the disease. The arrangement is that of grouping the different diseases according to the sequence of the orders of fungi rather than by host plants. After the enumeration and characterization of the various diseases, technical descriptions are given of the parasites causing them. There are also copious references to the literature.

Bacteria as the cause of plant diseases, G. A. NADSON (*Les bacteries, comme la cause des maladies des plantes. St. Petersburg, 1899, pp. 12*).

Protection of plants against fungi, T. BOKORNY (*Biol. Centbl., 19 (1899), pp. 177–185; abs. in Jour. Roy. Micros. Soc.* [*London*], *1899, pt. 4, p. 414*).—An enumeration is made of the various organic substances which serve to protect plants against attacks of fungi and schizomycetes. Of these the most widely distributed are the tannins, of which more than 1 per cent is necessary to be present in living plants in order to secure immunity against fungi or bacteria. Bacteria are said to offer less resistance to tannin than the mold fungi. The salts of oxalic acid are not poisonous to the lower fungi, while any free acid is injurious to the growth of them all. Essential oils are said to offer an effective protection against the attacks of all parasitic organisms.

Some diseases of our root crops, J. ERIKSSON (*K. Landt. Akad. Handl., 33 (1899), No. 2, pp. 63–76*).

The potato disease, H. TRYON (*Queensland Agr. Jour., 5 (1899), No. 1, pp. 57–63*).—Notes the occurrence of bacterial blight of potatoes, the same disease having been described in detail in this country by E. F. Smith (E. S. R., 8, p. 895). The disease was first noticed by the author and attention called to it in 1895. The identity of the two diseases is affirmed and the conclusions of the two authors are quite similar.

The diseases of hops, T. PETERSEN (*Natur, 47 (1899), No. 27, pp. 320, 321*).

Combating apple and pear scab, J. G. WEISS (*Vrtljschr. Bayer. Landw. Rath., 4 (1899), No. 4, pp. 373–377*).—Briefly describes the scab of apple and pear and suggests fungicides which may be profitably employed in preventing these diseases.

The cacao disease in Trinidad (*Bul. Roy. Bot. Gard. Trinidad, 1899, No. 21, p. 221*).—Briefly describes *Nectria bainii*, and says the disease has been recently found on pods growing on trees at the gardens. These pods were completely rotted. It was also observed on young shriveled and immature pods. Further investigation is required to determine whether the fungus is parasitic or saprophytic. It is associated with *Phytophthora omnivora*.

Combating true and false mildews, P. HELD (*Württemburg Wochnbl. Landw., 1899, No. 22, p. 341*).—Gives notes on the preventive treatment of *Oidium tuckeri* and *Peronospora viticola*.

On the browning of larch leaves, R. HARTIG (*Centbl. Gesam. Forstw. Wien, 25 (1899), No. 10, pp. 423–426, fig. 1*).—*Allescheria laricis* is described as new and is said to be the cause of considerable browning of larch leaves.

Abnormal growths on willow, peach, and apricot trees, P. MACOWAN (*Agr. Jour. Cape Good Hope, 15 (1899), No. 8, pp. 555–557, fig. 1*).—Attention is called to a number of abnormal growths occurring on willow, peach, and apricot trees. Roses are said to be attacked in the same way. The knot-like growths are soon followed by the death of the twigs bearing them. No definite cause is assigned, but the author thinks all excrescences should be burned and the general condition of the trees looked after.

On the manufacture of Bordeaux mixture, K. MOHR (*Mitt. Weinbau u. Kellerwirth, 1899, No. 5, pp. 70, 71*).

ENTOMOLOGY.

The temperature of insects according to observations made in Bulgaria, P. BACHMETJEW (*Ztschr. Wiss. Zool., 66 (1899), No. 4, pp. 521–604, figs. 5*).—The author, after making an extended experimental study of this subject, comes to the following conclusions: The temperature of insects may vary within wide limits without endangering the life of the insects. As the atmospheric temperature rises insects manifest no uneasiness at first, but at a temperature of 39° C. they begin to move rapidly and die at from 46 to 47° C. When the temperature of the air is lowered that of the insect rises, at first gradually, then rapidly, and later falls slowly. The point where the temperature suddenly rises is about the normal freezing point of fluids. By continued cooling insects die when the body temperature again sinks to the point at which the sudden rise took place. The manner of the thawing out of insects after their body fluids have been frozen has no noticeable influence upon their return to life, but only upon the intensity of their vitality. The critical point is not the same in different species, nor even in different individuals of the same species. The longer an insect has gone without food the lower is the normal freezing point of its body fluids. Repeated freezing lowers the critical point and also the normal freezing point of body fluids. The greater the proportion of fluid to the total weight of the body in different individuals of the same species the higher is the normal point at which heat rigor takes place. Twenty pages of this article are occupied with a discussion of the literature of the subject. A considerable number of species were used for these experiments, the majority being, however, Lepidoptera.

Problems of honeycomb, O. DAWSON and S. A. WOODHEAD (*Nat. Sci., 15 (1899), No. 93, pp. 347–350*).—The authors experimented with beeswax in thin sheets, heating it in a shallow tray and allowing it to cool slowly. It was found that the wax in cooling became arranged in hexagonal areas similar to those of natural honeycomb, but not quite so regular. With thin sheets of wax smaller hexagonal areas were formed than with thicker sheets. Sheets of wax cast in this manner were placed in observatory hives, and the bees, after excavating the slight quantity of débris which was formed within each hexagonal area, proceeded to work upon these plates as upon artificial foundation of the ordinary sort.

The extermination of mosquitoes, A. CELLI and O. CASAGRANDI (*Centbl. Bakt. u. Par., 1. Abt., 26 (1899), No. 13, pp. 396–402; Authors' Abs. from Atti Soc. Ital. Studi Malaria, Rome, July, 1899*).—The authors conducted numerous experiments for the purpose of finding suitable materials for killing the mosquito in the egg, larva, nymph, and adult stages. Permanganate of potash was found to operate slowly, even when used in a 5 per cent solution. Lime, copper sulphate, and ammonia are also slow in their action. Corrosive sublimate in a 1 per cent solution kills the larvæ slowly, but not the pupæ. Sulphur dioxid proved a very effective remedy. Of vegetable substances, the most effective mosquito destroyers were found in tobacco leaves and powders made from the unopened flowers of chrysanthemum. Then follow in order of their effectiveness infusions of quassia, *Solanum nigrun*, and daphne. Of the anilin dyes the most effective were larycith III, gallol, and malachite green. For destroying the nymph water saturated with sulphur dioxid gave the best results. Formalin and lysol were not very effective. Petroleum and olive oil applied as a layer on the surface of the water are effective agents in destroying the nymphs. Common salt and caustic lime give good results only when used in strong solution. For fighting the adult mosquito turpentine, iodoform, tobacco, and sulphur dioxid were found most valuable. Menthol, nutmeg, camphor, garlic, fumes of chrysanthemum flowers, eucalyptus leaves, and pyrethrum were of some service. Most of these remedies are, however, altogether too expensive to be used on a large scale. The authors believe that from an economic standpoint petroleum and mosquito powders made from the flowers of chrysanthemums are to be most highly recommended.

Preliminary report of the State board of horticulture, California, 1897-98 (*Sacramento, 1899, pp. 158, pls. 31, figs. 36*).—This report is occupied mainly with a description of the work of the board of horticulture, particularly in the way of importation of foreign beneficial insects, the study of insecticide methods for scale insects, and the maintenance of quarantine regulations against dangerous foreign scale and other insects. Among successful importations may be mentioned *Novius koebelei*, *Rhizobius ventralis*, and *Cryptolæmus montrouzieri*. A number of foreign insects are considered especially dangerous to the horticulture of the State, and these insects are figured and described as apt to be introduced. Among these pests may be mentioned *Trypeta ludens*, *T. acidusa*, *Leptops hopeii*, *Doticus pestilens*, *Dindymus versicolor*, *Laverna herellera*, *Dacus oleæ*, *Tephritis tryoni*, and *Halyerophora capitata*.

Formulas are given for insecticides as approved and recommended by the State board. Notes are given on the life history and means of combating cankerworm, tent caterpillar, tussock moth, peach-root borers, willow aphis, and codling moth. The quarantine officer and entomologist to the board, Mr. Alexander Craw, contributes a report on the work of inspection in various parts of the State, a brief article on methods of preserving scale insects for cabinet specimens, an account of the new scale insects that have been detected on shipments of nursery stock and quarantined, and a brief article on the subject of horticultural legislation with regard to our new possessions in the Pacific.

Twenty-ninth annual report of the Entomological Society of Ontario 1898 (*Rpt. Ontario Ent. Soc., 1898, pp. 120, figs. 71, pls. 3*).—This report contains a large number of brief articles of a popular nature on the insect enemies of the farmer and gardener, together with book notices, obituaries, and an amendment to the San José scale act for the regulation and fumigation of nursery stock.

In an article on injurious insects in 1898 (pp. 75-86) James Fletcher gives brief notes on the wheat midge, the Hessian fly, and the wheat jointworm (*Isosoma tritici*). Two parasites were reared from this insect—*Homoporus chalcidiphagus* and *Eupelmus epicaste*. The remedies recommended are burning or deeply plowing the stubble field or the removal and destruction by feeding or otherwise of the straw. Considerable damage is reported to have been caused by the pea moth (*Semasia nigricana*). As a remedy against this insect the author recommends deep plowing and early sowing and the cultivation of early varieties.

With regard to the clover-seed midge, the author found that feeding-off or mowing the crop before June 20 was a very satisfactory remedy.

The carrot-rust fly (*Psila rosæ*) is reported as doing considerable damage. The methods of prevention suggested by the author are late sowing and preventive remedies, such as kerosene emulsion diluted 1:10, to be sprayed along the drills by a knapsack sprayer.

The corn worm (*Heliothis armigera*) is said to be increasing in economic importance from year to year in Canada. The remedy which the author recommends most highly is hand picking and destruction of the caterpillars while at work in the ears of corn.

Report on the extermination of the gypsy moth (*Massachusetts State Bd. Agr. Rpt. 1898, pp. 411–481, pls. 11*).—The committee on gypsy moth reports on the general progress of its work. In reviewing the work, attention is again called to the fact that its effectiveness in the past has been impaired by lack of available funds at the particular times needed. C. H. Fernald, the entomologist to the State board of agriculture, gives an account of the present status of the gypsy moth and reiterates his belief that the moth can be ultimately exterminated.

The main part of the report is prepared by the field director, E. H. Forbush, who gives a detailed account of the apparatus used for destroying the gypsy moth and of the actual methods of conducting the various operations against this insect. An account is given of the winter and spring work, of the spring inspection, and of the extensive spraying operations with arsenate of lead. It is reported that during the year nearly 2,000,000 trees were burlapped. A machine has been invented for cutting rolls of burlap for use in winding the trees. Another device has been invented for rolling the cut strips into compact form. The cyclone burners are still used for burning over the ground of badly infested areas. It was found that stone walls and stone heaps could be as effectively treated by simple spraying with kerosene oil as with the cyclone burner. The former method is cheaper, and, all things considered, the best method yet devised for destroying the eggs in stone walls.

A general summary is given of the year's work showing the number of trees inspected, banded with insect lime, burlapped, sprayed, cut, trimmed, and acres of ground treated in various ways. A careful examination of extralimital towns disclosed the presence of a rather formidable colony of gypsy moth in Manchester, a locality from which the insect had not previously been reported. Vigorous operations were begun against this colony with good results.

A detailed account is given of the status of the gypsy moth in a large number of towns where it has been previously known. In general, the condition of affairs is better than heretofore, and with the larger appropriation which the committee has received, hopes are expressed of getting the insect entirely under control.

In an appendix to the regular report, E. H. Forbush figures and describes some improvements in spraying machinery. A pump has been devised by means of which one man can maintain a pressure of from 80 to 100 lbs. to the square inch. The pump can be used in any tank or barrel. The hose which is now used is ½ in. in size, and a special coupling has been invented which does not reduce the size of the hose at the joint. Considerable work has been spent in devising a telescoping extension tube for use in spraying high trees. The nozzle which has given best satisfaction is called the Monitor. It has 4 openings, 1 in front and 3 on the side, of equal size.

A. F. Burgess reports that *Anthrenus verbasci* is an enemy of the eggs of the gypsy moth. The larvæ of this beetle were found eating the eggs and also fed upon the eggs of the gypsy moth under confinement.

A. H. Kirkland reports the results of some experiments to determine the value of glucose in arsenical insecticides. The glucose had been used in the field in spraying for the gypsy moth upon the supposition that the insecticide was made to adhere much longer by the addition of glucose. Experiments made to determine that point were unfavorable in that it was found that the insecticide adhered almost equally well without the glucose, and the glucose is too expensive for insecticide use.

The San José scale in Massachusetts, A. H. KIRKLAND (*Massachusetts State Bd. Agr. Rpt. 1898, pp. 295–315, figs. 3*).—This paper contains a general account of the distribution of this scale, together with a description of the insect, a list of its food plants, and mention of its more common natural enemies. *Adalia bipunctata* and *Chilocorus bivulnerus* are recorded as enemies of this insect.

The well-known remedies, such as burning of badly infested trees and treatment with whale-oil soap, kerosene, and fumigation are described. The author experimented with whale-oil soap and water at the rate of 2 lbs. to 1 gal. upon young pear trees. A few scales survived the treatment.

Attention is called to the difficulties in the way of keeping the San José scale out of nurseries or of exterminating it when once a nursery has become infested. General directions are given for the guidance of nurserymen and purchasers.

Methods of improving the efficiency of spraying apparatus, E. S. GOFF (*Wisconsin Sta. Rpt. 1898, pp. 239–249, figs. 5*).—A device is described in which Bordeaux mixture as it is pumped out of the reservoir is taken from practically the whole depth simultaneously. Only so much stirring is necessary as to prevent the formation of a layer of sediment. In the ordinary pump and barrel arrangement there was substituted for the rubber suction tube a piece of gas pipe provided at its middle with a tee and reaching with a straight elbow at its lower end just to the bottom of the barrel. At this point a movable joint attaches another piece of gas pipe at right angles, to the farther end of which a float is attached. The latter pipe has an opening cut the whole length on one side. A third pipe reaches from the air chamber of the pump to the bottom of the barrel. When the pump is worked agitation enough is set up in the bottom of the barrel to prevent the formation of a layer of sediment.

The apparatus may also be used for spraying with kerosene and water. Opposite the suction pipe is erected a small iron rod, to which is attached a closed tin can of a gallon or more capacity in such a way that it is free to slide up and down the rod. Kerosene is poured into the can, which continues to float. The can is connected with the tee in the middle of the suction pipe by rubber tubing. The flow of kerosene is controlled by a stopcock and may be made sufficiently uniform for practical purposes.

Anticipated swarming, DEVAUCHELLE (*L'Apiculteur, 43 (1899), No. 10, pp. 440–445*).—An outline of methods for preventing natural swarming.

The determination of the sex of bees, B. SPOERER (*L'Apiculteur, 43 (1899), No. 10, pp. 437–440*).—This is a discussion of the Dzierzon-Dickel controversy.

Honey-bearing plants of agricultural importance, V. AGEENKO (*St. Petersburg, 1899, 2. ed., pp. 47; abs. in Selsk. Khoz. i Lyesov., 194 (1899), July, p. 184*).—Among the plants which are considered important as producers of honey are mentioned alfalfa, esparcet, white clover, phacelia, and melissa.

On the parasitic fly of silkworms in China, C. SASAKI (*Annot. Zool. Japonenses, 3 (1899), No. 1, pp. 25–27, figs. 3*).—The parasite is believed to be *Tachina rustica*.

The part played by insects, arachnids, and myriapods in the propagation of infective diseases of men and animals, G. H. F. NUTTALL (*British Med. Jour., 1899, Sept., pp. 642–644*).—This article discusses the part which insects may play in the spreading of various diseases, such as anthrax, plague, cholera, typhoid fever, etc. Insects may serve as intermediate hosts and under such circumstances they play a passive part in spreading disease when they are devoured by a host of the parasite which they contain. On the other hand, the cattle tick and the mosquito play an active part in transmitting infectious diseases of which they are the intermediate host.

Spider bites and "kissing bugs," L. O. HOWARD (*Pop. Sci. Mo., 55 (1899), No. 1, pp. 31–42, figs. 6*).—Probably only one species of spider in the United States can inflict a serious bite, *Latrodectus mactans*. Of the true bugs, the bites of a number of species are known to be more or less poisonous. Among them may be mentioned *Opsicoetes personatus, Melanolestes picipes, M. abdominalis, Conorhinus sanguisuga, Rasatus biguttatus*, and *R. thoracicus*. The press account of kissing bugs was much exaggerated, many supposed cases being the result of ordinary mosquito bites.

Lice on poultry and how to destroy them, F. V. THEOBALD (*Hoard's Dairyman, 30 (1899), No. 30, p. 596*).

Report of the entomologist, C. H. FERNALD (*Massachusetts Hatch Sta. Rpt. 1898, pp. 102–104*).—Brief notes are presented on the San José scale, grass thrips, small clover-leaf beetle (*Phytonomus nigrirostris*, and *P. punctatus*), and the carpet beetle. Arsenate of lead was tried in conjunction with the Bordeaux mixture with good results. The arsenate of lead was used in the proportion of 5 lbs. to 150 gal. of water. The apple scab was pretty effectively checked and various insects were destroyed.

Entomological notes for 1898, W. W. FROGGATT (*Agr. Gaz. New South Wales, 10 (1899), No. 9, pp. 873–879, pls. 2*).—*Phyllotocus macleayi* is reported as robbing beehives of their honey. *Galleruca semipulata* depredates on the leaves of *Ficus macrophylla*. A species of thrips is recorded as an enemy of the persimmon. *Agromyza phaseoli* tunnels in the stem of beans. *Cacœcia postvittana* is reported as attacking the rind of oranges. *Cryptophaga unipunctata* is a serious enemy of cherry trees, making tunnels in the trunks and branches.

Report on economic entomology for 1898, V. H. CARPENTER (*Reprinted from Rpt. Council Roy. Dublin Soc. 1898, pp. 14, figs. 13*).—This paper contains notes on the turnip beetle (*Phyllotreta nemorum*), cockchafer (*Melolontha vulgaris*), bean beetle (*Bruchus affinis*), cherry aphis (*Myzus cerasi*), *Bryobia prætiosa*, spruce aphis (*Chermes abietis*), pine aphis (*Lachnus piceæ*), and the pine sawfly (*Sirex gigas*).

An improved method of studying underground insects, J. B. SMITH (*Sci. Amer., 81 (1899), No. 7, p. 102*).—Moistened plaster of paris is poured into the burrows and allowed to set when it can be unearthed so as to show the exact form of the burrow.

The wings of insects (chapter IV concluded), J. H. COMSTOCK and J. G. NEEDHAM (*Amer. Nat., 33 (1899), No. 391, pp. 573–582, figs. 8*).—In this paper the authors discuss the tracheation of the wings of orthoptera and the homologies of the principal tracheæ in the wings of this order. The evidence as to the systematic position of the orthoptera which is to be obtained from a study of their wings, leads the authors to place the orthoptera second in the list of insect orders, with the Blattidæ as the lowest of the orthopterous families.

On the vitality of insects, E. ROY (*Nat. Canad., 6 (1899), No. 6, pp. 85–87*).—Gives observations on the effects of low temperatures in winter on insects.

Animal and plant gall formations, O. APPEL (*Schr. Phys. Oekon. Gesell. Königsberg, 39 (1898), pp. 82–139, pl. 1*).—This paper has for its purpose the systematic arrangement of our knowledge of the structure and origin of the various forms of plant galls. The author gives a classification of gall formations according to their external appearance and internal structure. The animals which are known to produce galls are classified and briefly discussed. The same method of treatment is given to various orders of plants which produce galls upon other plants. The plants which bear galls are listed with remarks upon comparative immunity of certain plants from galls. A brief discussion is given of the histology of galls. The author discusses in detail the development of the gall which is caused by the dipter *Hormomyia fagi* and also the various galls upon willows.

Contribution to the knowledge of galls produced by insects in Italy, A. TROTTER (*Riv. Patol. Veg., 7 (1898–99), Nos. 9–12, pp. 281–310, pls. 2*).—This article contains descriptions of gall formations caused by insects on species of Acer, Prunus, Pyrus, Quercus, and Salix.

Contribution to a knowledge of the insect galls of Juniperus communis, G. LAGERHEIM (*Ent. Tidskr., 20 (1899), No. 2–3, pp. 113–125, figs. 4*).

Diseases of cultivated plants in the Province of Groningen in 1898, J. RITZEMA-BOS (*Bijdragen Kennis Provincie Groningen, 1 (1899), No. 1, pp. 33–62*).—Notes on various parasitic fungi, injurious insects, limax, and nematode worms.

The beetles of Middle Europe, L. GANGLBAUER (*Die Käfer von Mitteleuropa. Vienna: C. Gerold's Son, 1899, pt. 2, pp. 409–1046, figs. 16*).—A monographic account of the beetles in this region belonging to the following families: Sphæritidæ, Ostomidæ, Byturidæ, Nitidulidæ, Cucujidæ, Erotylidæ, Phalacridæ, Thorictidæ, Lathridiidæ, Mycetophagidæ, Colydiidæ, Endomychidæ, and Coccinellidæ.

Wireworms (*Rpt. Agr. Expts. Cornwall County Council, 1898, pp. 45–48*).—Experiments were made on 2 farms, 13 plats being treated on each farm for the destruction of wireworms. The substances used were rape cake soaked in an arsenic solution, rape cake dusted with arsenic, rape cake alone, arsenic alone, mustard dross, mustard cake, and castor oil seed cake. None of these substances had any appreciable effect upon the wireworms. The remedies which seem to be practicable and at the same time effective are fall plowing and a rotation of crops. The wireworm winters over in a nearly adult stage within an earthen cell which was made for the protection of the pupæ. It was found that whenever these cells were broken the wireworms perished. Deep and thorough plowing is therefore recommended for holding these pests in check.

Preliminary report on insect enemies of clover and alfalfa, L. BRUNER and W. D. HUNTER (*Nebraska State Bd. Agr. Rpt. 1898, pp. 239–285, figs. 67*).—This is a biological account of the insects most injurious to clovers and related forage legumes, with biographical references for 175 species reported as depredating upon these plants.

Insects and other pests injurious to cotton in Egypt, G. P. FOADEN (*Jour. Khed. Agr. Soc. and School Agr., 1 (1899), No. 3, pp. 85–96*).—Gives economic and biological notes with suggestions for treatment against *Prodenia littoralis*, *Earias insulana*, *Aphis ulmariæ*, *Oxycarenus hyalipennis*, and a fungus disease caused by a member of the Uredineæ.

The coccid genera, Chionaspis and Hemichionaspis, R. A. COOLEY (*Massachusetts Hatch Sta. Spec. Bul., Aug. 10, 1899, pp. 57, pls. 9*).—This bulletin contains a monographic account of the genus Chionaspis in a restricted sense, and of Hemichionaspis as including a number of species previously referred to Chionaspis. Synoptic tables are given for the identification of species and brief biological notes in connection with the species which are of economic importance. Bibliographies are given in connection with each species.

The most common scales introduced upon American fruits, L. REH (*Illus. Ztschr. Ent., 4 (1899), No. 14, pp. 209–211, fig. 1*).—The San José scale is considered as the most dangerous enemy, and is figured and described.

Notes on the Mediterranean fruit fly and Queensland fruit fly, A. M. LEA (*Bul. Dept. Agr. Tasmania 1899, pp. 6, pl. 1*).—The author reports that the Mediterranean fruit fly, *Halterophora capitata*, has been introduced in fruit from Sidney into Tasmania. The first shipment of fruit which was seen to be infested with the Mediterranean fruit fly was destroyed by boiling, but, as a number of the larvæ of the fly had already escaped from the decaying fruit, the ground was thoroughly treated with kerosene oil. Two gardens became infested from fruit which was shipped in, and the ground underneath the trees was also thoroughly sprayed with kerosene so that it became moist to a depth of 2 in. No serious fear is entertained concerning the Queensland fruit fly (*Tephritis tryoni*), for the reason that it has so far not appeared to thrive except in tropical climates.

Peach borer, M. BURRELL (*Ontario Fruit Growers' Assoc. Rpt. 1898, pp. 15–17*).—Gives observations on the habits of this moth and notes on remedies which were used against it.

Phylloxera of the grapevine, BLUNNO and FROGGATT (*Agr. Gaz. New South Wales, 10 (1899), pt. 5, pp. 377–379, pls. 4*).—Gives the life history of the different forms of this insect, with an account of the use of carbon bisulphid as an insecticide.

The chestnut weevils, G. H. POWELL (*Amer. Gard., 20 (1899), No. 235, p. 444*).—Gives a description and the life history of the weevil. The methods of control which are suggested are the following: Planting chestnut orchards some distance from native chestnut trees, jarring the weevils from young trees in the orchard, the use of trap trees, and the destruction of the burs from them.

Description of Agromyza phaseoli, a new species of leaf-mining fly, D. W. COQUILLETT (*Proc. Linn. Soc. New South Wales, 24 (1899), No. 93, pp. 128, 129*).—It is reported as having caused considerable damage to French beans.

A new tea pest from India, E. E. GREEN (*Ent. Mo. Mag., 2. ser., 10 (1899), No. 118, pp. 225, 226, figs. 6*).—A description of *Cerococcus ficoides* with brief notes on its habits.

The development of Ceroplastes roseatus, C. H. DOLBY-TYLER (*Trans. Ent. Soc. London, 1899, No. 3, pp 277–280, pl. 1*).—A detailed record of the changes of form, of the habits and rate of growth of this scale. It is parasitized by *Lecaniobius cockerelli* and is preyed upon by *Azya luteipes*.

Epicometis hirta, S. A. MOKRZHETZKY (*Odessa, 1899, pp. 24; abs. in Selsk. Khoz. i Lyesov., 194 (1899), July, pp. 180, 181*).—The author discusses in a critical manner the literature relating to this insect, and from personal observations describes the habits and appearances of the insect throughout its different stages of development. Appropriate remedies are recommended against its devastations.

The Hessian fly, E. P. FELT (*Country Gent., 64 (1899), No. 2428, pp. 668, 669*).—Gives biological notes on the insect, and advises rotation of crops as a remedy against its ravages.

Injuries caused by Hylastes trifolii, G. CECCONI (*Riv. Patol. Veg., 8 (1899), Nos. 1–6, pp. 160–165, pl. 1*).—Besides injuring trees by making galleries under the bark, this insect is reported as depredating to a considerable extent upon common clover.

Hyponomeuta malinella, G. BARBUT (*Prog. Agr. et Vit., 16 (1899), No. 37, pp. 305–309, fig. 1*).—The habits of the insect on apple trees are described. Its natural enemies are mentioned and an account is given of several remedies which are to be used against it.

The Lantana bug (Orthezia insignis), E. E. GREEN (*Roy. Bot. Gardens Ceylon Circ., 1. ser., 1899, No. 10, pp. 83–94*).—Popular notes on its injurious activity and a discussion of remedies.

Lymantria monacha, S. LAMPA (*Ent. Tidskr., 20 (1899), No. 2–3, pp. 81–88, pl. 1*).—An account of its habits, life history, natural enemies, and of remedies which were tested for exterminating it.

Mindarus abietinus on the white fir, O. NÜSSLIN (*Allg. Forst u. Jagd. Ztg., 75 (1899), pp. 210–214, figs. 5*).—Contains detailed notes on its life history with figures of its different stages and of its injury. The distribution of the insect is discussed.

The Oestridæ and their economic significance, A. BERGMAN (*Ent. Tidskr., 20 (1899), No. 2–3, pp. 133–155, pls. 2*).—A study of the injuries suffered by domesticated animals from the attack of these insects.

A pasture problem, H. FRIEND (*Gard. Chron., 3. ser., 25 (1899), No. 651, pp. 391, 392, figs. 5*).—An Oligochæt worm of the family Enchytræidæ, and known as *Fridericia agricola*, is reported as being found apparently injuring grass. The details of the external and internal anatomy of the worm are described and illustrated.

Phylacteophaga eucalypti, W. W. FROGGATT (*Proc. Linn. Soc. New South Wales, 24 (1899), No. 93, pp. 130–134, pl. 1*).—This insect is described as new, with an account of its depredations upon the foliage of *Eucalpytus globulus*.

Notes on the oak caterpillar (Phryganidia californica), P. SERRE (*Jour. Soc. Nat. Hort. France, 3. ser., 21 (1899), Aug., pp. 756–761, figs. 4*).—The life history of the insect is given. *Pimpla behrensi* is said to be parasitic on it. Paris green and London purple are recommended as remedies.

The purplish-red borer, L. ZEHNTNER (*Verslag Proefsta. Suikerriet, West Java, 1898, pp. 27–29*).—Brief notes on the appearance and habits of *Sesamia nonagrioides*.

Contribution to the study of the anatomy and biology of Trama radicis, G. DEL GUERCIO (*Nuova Relaz. R. Staz. Ent. Agr., 1. ser., 1899, No. 1, pp. 195–206, figs. 6*).—This article contains an account of the structure of the insect and is accompanied by figures illustrating the different stages. The biology of the insect is also considered from an economic standpoint, and the use of bisulphid of carbon and other remedies is recommended.

Life habits of Xyleborus cryptographus, H. EGGERS (*Illus. Ztschr. Ent., 4 (1889), No. 19, pp. 291, 292, fig. 1*).—A study of the galleries and of the life history of this insect.

The wood leopard moth (Zeuzera æsculi) (*Jour. Bd. Agr. [London], 6 (1899), No. 2, pp. 195–198, fig. 1*).—A brief description is given of the insect in its several stages as well as an outline of its life history. Few remedies are effective in controlling its depredations. While the burrows of the larvæ are still small, solutions of carbolic acid and similar substances have been forced into the openings without very good results. A number of species of birds are known to attack the insect in the larval condition, and a still greater number feed upon the adult insect.

Fungus disease of plant lice in the summer of 1896, G. LAGERHEIM (*Ent. Tidskr., 20 (1899), No. 2–3, pp. 127–132*).—*Empusa aphidis* and *E. fresenii* are reported to have greatly reduced the numbers of plant lice.

Remedies for sugar-beet insects, E. D. SANDERSON (*Michigan Sugar Beet, 1 (1899), No. 17, p. 1, figs. 4*).—Popular notes on remedies to be used against the more destructive insects which attack sugar beets.

The spraying of fruit trees (*Jour. Bd. Agr. [London], 6 (1899), No. 1, pp. 1-4*).—General recommendations and formulas for the common insecticides.

How to kill grasshoppers, L. BRUNER (*Breeders' Gaz., 36 (1899), No. 4, p. 92*).—Recommends the protection of native birds and reptiles and use of the hopperdozer.

Spraying for orchard pests, J. FLETCHER (*Ontario Fruit Growers' Assoc. Rpt. 1898, pp. 77-85*).—Economic and biological notes on the codling moth and the San José scale.

Remedies against Cochylis (*Prog. Agr. et Vit. (Éd. L'Est), 20 (1899), No. 24, pp. 709, 710*).—Recommends the use of an insecticide made as follows: Black soap 70 gm., rape oil 45 gm., and essence of lavender, 75 gm. The whole to be emulsified in 1 liter of water.

Instructions in spraying (*Ontario Dept. Agr. Spec. Bul., March, 1899, pp. 32, figs. 39*).—This bulletin contains formulas and directions for making the more common insecticides, with notes on their application, together with a list of the more common insect and fungus diseases of garden and fruit crops. The most common injurious insects found upon these crops are figured, briefly described, and remedies suggested in each case.

A table of the most frequently used compounds (insecticides and fungicides) in combating the insect and fungus diseases of fruit gardens, S. A. MOKRZHETZKY (*Simferopol, 1899, 2. ed., pp. 15; abs. in Selsk. Khoz. i Lyesov., 194 (1899), July, pp. 180, 181*).—This work gives in tabular form directions for preparing a number of insecticides and fungicides, among which may be mentioned barium chlorate, Bordeaux mixture, Raupenleim, copperas, lime and tobacco dust, kerosene emulsion, carbolic emulsion, creosote, and Paris green.

FOODS—ANIMAL PRODUCTION.

"Sticky" or "slimy" bread and its cause, H. L. RUSSELL (*Wisconsin Sta. Rpt. 1898, pp. 110-113*).—The author states that during the two preceding summers a number of complaints were received at the station that bread became slimy when kept for a short time. A sample received at the station when first baked showed no signs of an abnormal character; in fact, a part of the quantity baked "had been consumed before the change became apparent. In the course of 3 or 4 days after baking, the bread began to change in color slightly, assuming a light brown tint. It had a sweetish taste and a peculiar odor. When touched it appeared sticky, a condition that later became so marked that it would string out in long threads several feet in length."

A bacteriological examination showed that this trouble was due to the potato bacillus (*Bacillus mesentericus vulgatus*). The temperature of the interior and exterior of the loaf during the baking of Graham gems and wheat bread was determined, and it was found that it was not sufficiently high to destroy the bacilli.

> "After baking for an hour and a half, the temperature at no time had been sufficiently high to destroy this organism, if it had been in a spore stage. These experiments on the insufficiency of the baking temperature to destroy the germ in a latent condition, in connection with the experiment already mentioned where infected yeast was used, show conclusively that these bacteria would not be destroyed under ordinary treatment.
>
> "Undoubtedly if the yeast is impure, as it appears to have been in these cases, such troubles will be more or less common, especially if the weather should be such as to favor bacterial growth. . . .

"Until greater care is used by the yeast manufacturers in the preparation of their yeasts, such troubles are likely to occur during the hot summer weather. The only help that can be suggested is to hold the bread at a low temperature after it is baked, so that the spores that are present in the same will not germinate so rapidly. This combined with small bakings that are used up within 2 to 3 days will materially diminish the difficulty.

"Just how such foreign organisms find their way into the yeast has not yet been studied. The trouble need not cause any special alarm from a sanitary standpoint, for the organism causing the change is a saprophytic form that is widely spread. As soon as the fermentative change begins to be well marked it is apparent enough to the taste, so that bread affected with the same would be quickly rejected as food. Considerable losses, however, are reported, and from the economic standpoint the matter during this past year is by no means an insignificant one."

Digestion experiments, J. B. LINDSEY ET AL. (*Massachusetts Hatch Sta. Rpt. 1898, p. 43*).—During the past 3 years about 40 successful digestion experiments have been made at the station, in the majority of cases with concentrated feeding stuffs. The experiments have not been published in detail. Some of the coefficients of digestibility have been previously reported; others follow:

Coefficients of digestibility of different feeding stuffs.

Kind of feed stuff.	Number of trials.	Dry matter.	Protein.	Fat.	Extract.	Fiber.	Ash.
		Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
Hay (largely *Poa pratensis*)	6	62	61	50	63	65	46
Do	4	60	58	53	61	60	50
Average, both samples	10	61	60	51	62	63	48
Hay of mixed grasses (late cut)	2	53	54	39	54	56	26
Do	2	57	55	44	57	59	42
Barnyard millet hay (late blossom)	3	57	64	46	52	62	63
Barnyard millet (green, in blossom)	2	74	68	64	76	74	66
Barnyard millet (green, week later than above)	1	67	72	61	65	71	61
Peas and oats (green, in blossom)	3	70	70	57	76	68	49
Vetch and oats (green, in blossom)	3	67	75	47	68	68	53
Corn silage (Pride of the North)	2	74	45	77	82	80	26
Hominy meal	1	89	53	94	94	....	....
Cerealine feed	3	90	80	81	95	82	....
Peoria gluten feed	3	91	85	88	95	....	....
Quaker oat feed	3	62	81	89	67	43	....
Victor corn-and oat feed	3	75	71	87	83	48	....
H. O. dairy feed	2	65	78	85	70	41	....
H. O. horse feed	1	70	74	84	79	35	....

Cleveland flax meal vs. the old-process linseed meal for early lambs, J. B. LINDSEY ET AL. (*Massachusetts Hatch Sta. Rpt. 1898, pp. 24–27*).—The comparative value of Cleveland flax meal and old-process linseed meal was tested with 10 grade Southdown lambs divided into 2 lots of 5 each. The lambs were dropped by 6 ewes. The ewes and the lambs were fed separately.

The lambs in lot 1 were fed all they would eat of a grain mixture of flax meal, bran, and corn meal, 3:3:4. After about two weeks the ration was changed to flax meal, bran, and corn meal, 2:1:1. When the lambs had reached about 40 lbs. in weight, the ration was again changed, and a mixture of equal parts of the grains was fed. Lot 2 was fed the same rations, except that old-process linseed meal was substituted for flax meal. The lambs were kept in pens with the ewes and had the run of a large yard during the warmer part of sunny days.

The average duration of the test with lot 1 was 79 days, the average weight of the lambs 5 days after dropping, 10.95 lbs., and the average gain, 42.25 lbs. The average duration of the test with lot 2 was 76 days, the average weight of the lambs when dropped, 10.15 lbs., and the average gain, 39.85 lbs.

At the close of the test the lambs were slaughtered. The following conclusion was drawn:

"The flax meal had no injurious effect either upon the growth or dressed appearance of the lambs, and both sets of lambs produced the same average daily growth, and were both in the same average condition when slaughtered. In addition to inherited constitution and plenty of milk, it is very essential, in order to secure rapidity of growth, that early lambs should be housed in a warm, dry barn, and have a maximum amount of sunlight from a southern exposure."

Farm grains for fattening lambs before and after weaning, W. L. Carlyle (*Wisconsin Sta. Rpt. 1898, pp. 17–23*).—A test was made to compare different farm grains for lambs before and after weaning. Four lots were used in the trial, each made up of 4 grade Shropshire ewes and 6 lambs. For 2 weeks before the beginning of the test proper, the ewes and lambs were fed a mixture of cracked peas, bran, oats, and corn meal to accustom them to grain, since it has been found that there is some difficulty in getting young lambs to consume corn meal or bran alone. The food consumed and gains made during this period are recorded.

The test proper began May 27 and covered 2 periods, i. e., 5 weeks before and 5 weeks after weaning. Lot 1 was fed cracked peas, lot 2 bran, lot 3 whole oats, and lot 4 corn meal. Before weaning, the lambs were given all they would eat up clean. After weaning, the ration was limited to ½ lb. of grain per day for each lamb. While the lambs were with the ewes, they were turned out every day on a blue grass pasture, and were kept in yards at night. Two pens were provided for each lot, the one for feeding the lambs being separated from the other by a "creep," which allowed the lambs to pass back and forth at will, but did not admit the ewes to the feeding pens of the lambs.

The financial statement is based on oats at 20 cts., corn 30 cts., and peas 45 cts. per bushel, and bran at $13 per ton.

The principal results of the trial are shown in the following table:

Results of feeding farm grain to lambs before and after weaning.

	Before weaning.			After weaning.			Whole test.		
	Total gain.	Average daily gain.	Grain eaten per pound of gain.	Total gain.	Average gain.	Grain eaten per pound of gain.	Total gain.	Grain eaten per pound of gain.	Cost per pound of gain.
	Lbs.	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Cent.*
Lot 1 (peas)	102.5	2.67	0.71	205.0	1.72	1.69	308	1.10	0.82
Lot 2 (bran)	96.0	2.57	.53	195.5	1.21	2.30	265	1.10	.72
Lot 3 (oats)	109.5	3.01	.52	211.0	1.87	2.20	307	1.05	.65
Lot 4 (corn meal)	120.0	3.10	.55	208.5	1.80	1.60	343	.96	.51

"As far as cost is concerned, corn gave the best results, with oats ranking next and bran in the third place, while peas were the most expensive feed. It would seem that cracked peas are very expensive feed when fed to young lambs, as they evidently consume more of them than they can properly assimilate or give returns for. . . . It is our purpose to repeat the experiments along this line until sufficient data have been gathered to establish some facts about the comparative value of different farm grains for lamb feeding."

Corn meal vs. hominy meal, and corn meal vs. cerealine feed for growing pigs, J. B. LINDSEY ET AL. (*Massachusetts Hatch Sta. Rpt. 1898, pp. 27–42*).—Corn meal and hominy meal were compared with 2 lots of grade Chester White pigs from the same litter. Lot 1 was made up of 4 pigs, and lot 2 of 3 pigs. Before the test all of the pigs were fed skim milk alone.

The test began November 23, 1896, and covered 98 days. At the beginning the pigs in lot 1 were fed from 7 to 10 qts. of skim milk per head daily and from 3 to 6 ozs. of corn meal per quart of milk, the amount depending on the appetite and stage of growth of the pigs. As the test progressed the quantity of grain was increased. The pigs in lot 2 were fed the same ration, except that hominy meal was substituted for corn meal.

During the test the pigs in lot 1 consumed on an average 1,925.49 lbs. of skim milk and 255.44 lbs. of corn meal. The average weight of the pigs at the beginning of the test was 55.5 lbs., and the average gain per pig 125.75 lbs., the pigs requiring 3.2 lbs. of dry matter per pound of gain (live weight).

The pigs in lot 2 consumed on an average 1,926.39 lbs. of skim milk and 255.19 lbs. of hominy meal. The average weight of the pigs at the beginning of the test was 57.75 lbs., and the average gain per pig 136.66 lbs.; 3.06 lbs. of dry matter were required per pound of gain (live weight).

The pigs were slaughtered at the close of the test. The average loss in weight in dressing lot 1 was 18.28 lbs. and lot 2, 21.67 lbs. In the authors' opinion the very slight difference between the gains made by the 2 lots is within the limits of error.

Corn meal vs. cerealine feed (pp. 32–36.)—Two tests of the comparative value of corn meal and cerealine feed are reported. The first, which began April 12, 1897, and covered 106 days, was made with 6 grade Chester White pigs divided into 2 lots of 3 each. The pigs were about 7 weeks old at the beginning of the test.

Lot 1 was fed from 6 to 9 qt. of skim milk per head daily and 3 oz. of corn meal per quart of milk. As the test progressed the amount of meal was gradually increased until about 4 lbs. was fed per head daily. Lot 2 was fed the same ration except that cerealine feed was substituted for corn meal. At the close of the test the pigs were slaughtered. During the test each lot consumed on an average 1,608.84 lbs. of skim milk and 243.63 lbs. of corn meal.

The average weight of the pigs in lot 1 at the beginning of the test was 47.67 lbs. and the average gain 137.75 lbs., 2.6 lbs. of dry matter being required per pound of gain (live weight). The average weight of the pigs in lot 2 at the beginning of the test was 44.75 lbs. and the average gain 132.58 lbs., the average amount of dry matter required per pound of gain being 2.77 lbs. (live weight).

In the authors' opinion the figures show a slight difference in favor of the corn meal as compared with cerealine feed, rather less dry matter of the former being required to make a pound of gain than of the latter.

The second test, which began October 25, 1898, and covered 78 days, was made with 2 lots of 3 each of Poland-China Chester White pigs. They were about 9 weeks old at the beginning of the test. The experimental conditions were similar to those in the previous test. During the test the pigs in each lot consumed on an average 1,020.24 lbs. of skim milk. In addition to this the pigs in lot 1 were fed on an average 220.5 lbs. of corn meal, and those in lot 2 225.2 lbs. of cerealine feed.

At the beginning of the test the pigs in lot 1 weighed on an average 67.67 lbs. and gained on an average 104.83 lbs., requiring 2.81 lbs. of dry matter per pound of gain (live weight). The pigs in lot 2 weighed on an average 66.58 lbs. at the beginning of the test and gained on an average 97.75 lbs., requiring 3.05 lbs. of dry matter per pound of gain (live weight).

On the basis of these 2 tests the authors believe that corn meal is from 5 to 10 per cent more valuable than cerealine feed for feeding in connection with skim milk to young and growing pigs.

The composition of the feeding stuffs used in the above tests is given.

The cost of pork production (pp. 36–42).—The cost of production of pork is discussed at some length, the object being to ascertain "the price that skim milk has returned per quart; the cost of feed required to produce a pound of live or dressed weight, taking the various grains at a reasonable range of market prices, and allowing either ¼ or ½ ct. per quart for the milk."

The discussion is based on a large number of tests made at the station with 140 pigs, weighing on an average 37 lbs. at the beginning of the tests and 183 lbs. at the close. The pigs were fed from 5 to 7 qt. of skim milk per head daily and 3 oz. of corn meal or other feeding stuff rich in carbohydrates. Some of the pigs were fed about the same quantity of skim milk together with from 3 to 6 oz. of corn meal per quart of milk, and in addition enough of a mixture of equal amounts of corn meal, wheat bran, and gluten meal to satisfy their appetites. "We rarely had more than from 5 to 7 qt. of milk daily for each pig. The animals did well with this amount of milk. If they did not secure this quantity, their growth was noticeably slower."

The average price obtained for skim milk, with other feeding stuffs and dressed pork at different prices, is shown in the following table:

Average price obtained for skim milk per quart and per 100 lbs. when fed to pigs.

Average price per ton of other feeding stuffs.	Returns per quart of skim milk with pork at—			Returns per 100 lbs. of skim milk with pork at—		
	Five cents.	Six cents.	Seven cents.	Five cents.	Six cents.	Seven cents.
	Cent.	*Cent.*	*Cent.*	*Cents.*	*Cents.*	*Cents.*
Corn meal and other starchy feeds, $15; "other grains," $17.50	0.50	0.67	0.83	23.07	30.73	38.19
Corn meal and other starchy feeds, $17.50; "other grains," $20	.45	.61	.78	20.66	28.14	35.86
Corn meal and other starchy feeds, $20; "other grains," $22.50	.39	.56	.78	18.08	25.82	35.70

The average cost of feed per pound of growth is shown in the following table:

Average cost of feed per pound of growth produced.

	Live weight.	Dressed weight.
	Cents.	*Cents.*
With corn meal at $15, "other grains" at $17.50, milk at ¼ ct. per quart	2.78	3.47
With corn meal at $15, "other grains" at $17.50, milk at ⅓ ct. per quart	4.00	4.99
With corn meal at $17.50, "other grains" at $20, milk at ¼ ct. per quart	3.04	3.79
With corn meal at $17.50, "other grains" at $20, milk at ⅓ ct. per quart	4.25	5.31
With corn meal at $20, "other grains" at $22.50, milk at ¼ ct. per quart	3.63	4.53
With corn meal at $20, "other grains" at $22.50, milk at ⅓ ct. per quart	4.51	5.63

Rape vs. clover for growing pigs, W. L. CARLYLE (*Wisconsin Sta. Rpt. 1898, pp. 21–29*).—A test which is a continuation of previous work (E. S. R., 10, p. 773) was made with 2 lots of pigs to compare rape and clover. Each lot was made up of 6 pure-bred Poland Chinas and 14 grade Poland Chinas. There were 8 sows and 12 barrows in each lot. The pigs were from 5 to 6 months old at the beginning of the test and nearly uniform in size and weight. The test began September 6, 1897, and covered 9 weeks. It was divided into 4 periods of 2 weeks each and 1 of 1 week. One pig was dropped from each lot in the third period on account of sickness.

Lot 1 was hurdled on rape, being allowed the run of a very small area at first to guard against trampling down and wasting the rape. After a time the area was increased. The pigs were fed twice a day a liberal quantity of corn meal and shorts, 2:1, mixed with water to a thick slop. They also had access to a small blue-grass plat with some trees which afforded shade. Lot 2 was allowed the run of a 10 acre field of clover. It had been cut early in July, and one-half of the field was again cut about the middle of August. Owing to dry weather, the clover was much withered. There was an abundance of shade in the field. The pigs were fed the same grain ration as lot 1. Both lots received plenty of fresh water and were given the same care and management. During the test lot 1 ate the rape from about two-thirds of an acre.

At the beginning of the test lot 1 weighed 2,111 lbs. and lot 2, 2,091 lbs. Lot 1 gained 1,043 lbs., consuming 4,083.75 lbs. of grain in addition to the rape. Lot 2 made a total gain of 941 lbs., consuming the same amount of grain in addition to the clover.

"This experiment would seem to indicate that pigs averaging about 6 months old when pastured on rape will make a more rapid gain than a similar lot pastured on clover, the feed and management in other respects being the same. . . .

"The pigs on the rape were remarkably thrifty all through the experiment. They evidently relished the rape during the whole period and it apparently had a beneficial effect in regulating the bowels. . . .

"Farmers not having a suitable clover pasture for their brood sows and young pigs will do well to sow a small piece of rape at successive periods during the spring months. These may be pastured off in turn. When a plat is eaten off and the hogs removed, the rape immediately starts to grow again from the root and will usually be ready to feed off again in from 6 to 8 weeks under favorable conditions of soil and season. In the manner given the pigs (and sheep as well) may be supplied a succulent feed throughout the growing season."

Whole corn compared with corn meal for fattening swine, W. A. HENRY (*Wisconsin Sta. Rpt. 1898, pp. 8-16*).—In continuation of previous work (E. S. R., 10, pp. 776, 777) 2 tests are reported comparing whole corn and corn meal for pigs. The first test, which began December 8, 1897, and covered 12 weeks, was made with 2 lots of 8 grade Berkshire and Poland China pigs. They were about 8 months old at the beginning of the test.

Previous to the trial the pigs had been pastured on rape or red clover and were given some grain in addition. The test proper was preceded by a preliminary period of 7 days' duration. Lot 1 was fed corn meal and wheat middlings 2:1, mixed together with warm water to a thick slop. Lot 2 was fed shelled corn and wheat middlings 2:1. The corn was fed first. After it was eaten, the middlings were given mixed with warm water to a thick slop. The pigs were supplied freely with salt, water, and soft-coal ashes.

Lot 1 weighed 1,496 lbs. at the beginning of the test and lot 2, 1,474. The gains made by the 2 lots were 992 and 830 lbs., respectively. Lot 1 consumed 3,132 lbs. of corn meal and 1,566 lbs. of wheat middlings. Lot 2 consumed 2,758 lbs. of shelled corn and 1,379 lbs. of wheat middlings.

The second trial was regarded as a duplicate of the first in all particulars. The lot fed corn meal weighed 1,474 lbs. at the beginning of the trial and gained 1,030 lbs., consuming 3,078 lbs. of corn meal and 1,539 lbs. of wheat middlings. The pigs fed shelled corn weighed 1,471 lbs. at the beginning of the trial and gained 799 lbs., consuming 2,609 lbs. of shelled corn and 1,304½ lbs. of wheat middlings.

From these tests and previous work of the station some general deductions are drawn. The trials, extending over 3 years, show that—

"The pigs fed whole shelled corn made an average daily gain of 1.34 lbs., while the lots which were fed corn meal made an average daily gain of 1.63 lbs. This is a difference of 0.29 lb. daily, or about 2 lbs. per week greater increase through feeding corn meal.

"Coming to the last item in the table we learn that 459 lbs. of the corn-meal ration produced 100 lbs. of gain, live weight, with these pigs, while 498 lbs. of the ration containing shelled corn were required for the same gain. Thus by grinding corn to meal 39 lbs. of grain were saved on 498 lbs. This shows that about 8 per cent of the grain may be saved by grinding when feeding old corn in combination with middlings to fattening swine.

"A study of the total quantity of feed required by the different lots of pigs in these trials as summarized in the tables shows that the pigs getting corn meal uniformly consumed a larger quantity of feed daily than those fed whole corn. Through the larger consumption of feed the pigs were enabled to make a more rapid daily gain than those getting whole grain. . . .

"It is shown by these trials that corn meal effected a saving of 8 per cent over whole corn and the pigs receiving the corn meal gained about 2 lbs. per week more than the others.

"Practical feeders who examine these figures will probably be surprised at the comparatively small saving in the amount of corn through grinding. The higher value placed on corn meal in comparison with whole corn by feeders generally is perhaps largely due to the more rapid gains made by pigs receiving meal instead of whole grain."

Poultry experiments, W. P. BROOKS (*Massachusetts Hatch Sta. Rpt. 1898, pp. 85–101*).—In continuation of previous work (E. S. R., 10, p. 675) experiments are reported on the effect on egg production of (1) condition powder, (2) animal meal *vs.* cut fresh bones, (3) wide *vs.* narrow rations, and (4) the presence of the cock with the flock. Each test was made with 2 lots of 20 well-bred barred Plymouth Rocks hatched in April. Each lot occupied a separate house with roosting room and scratching shed and were permitted the run of large yards in favorable weather. All the fowls were marked with leg bands. All the lots were fed grain, the meals and clover being fed in the form of a mash. During the early winter it was mixed at night with boiling water and fed at a temperature of about 70°. Later in the season the mash was mixed with boiling water in the morning and fed hot. The whole grain fed was scattered in the straw with which the sheds were littered. The chickens were at all times supplied with water, crushed oyster shells, and grit, and about twice a week were given cabbage.

The composition of the feeding stuffs is reported. The financial statement of the test is based on the following prices per 100 lbs.: Wheat, $1.75; oats, $1; wheat bran, 60 cts.; wheat middlings, 75 cts.; gluten feed, $2; animal meal, $2; cut clover rowen, $1.50; cabbage, 25 cts.; cut bone, $2; gluten meal, 80 cts.; corn meal, 85 cts.; and corn, 85 cts.

The effect of condition powder upon egg production (pp. 88–90).—A test of the influence on egg production of condition powder was begun December 12 and closed April 30. Both lots of pullets were fed wheat, oats, bran, middlings, gluten feed, animal meal, clover, and cabbage. In addition lot 1 was fed condition powder, about 8 lbs. of which was consumed, which would cost at retail $4. The results of the test are summarized in the table following.

Results of feeding poultry with and without condition powder.

	Food consumed.		Cost of food per day per fowl.	Number of eggs produced.	Weight per egg.	Cost of food per egg.
	Lbs.	*Ozs.*	*Cent.*		*Ounces.*	*Cents.*
Lot 1	647	11	0.32	745	1.95	1.15
Lot 2 (condition powder)	666	15	.32	719	1.96	*a* 1.30

a Including the condition powder.

The quality of the eggs was tested by 2 families. One family reported no difference; the other found the eggs from the hens receiving no condition powder much preferable to those from the other lot. The author notes that in this test and those previously reported the difference in egg production of the lots fed condition powder and those not receiving it has been small.

> "In favor of the condition powder we have 1 experiment, against it we have 2 experiments. It is not, however, . . . claimed that the powder is injurious, but simply that it is not beneficial. This the 4 experiments, carried out with the utmost fairness and with every care, certainly prove. In the light of these results it is believed that poultry keepers throw away money expended for condition powder."

Animal meal vs. cut bone for egg production (pp. 90–93).—The test to compare animal meal and cut bone for egg production was begun December 12 and closed April 30. Both lots were fed wheat, oats, bran, wheat middlings, clover rowen, and cabbage. In addition lot 1 was fed gluten feed and animal meal and lot 2 gluten meal and cut bone. The health of the fowls fed animal meal was, in general, good; 1 fowl became ill and was killed. Bowel troubles were not uncommon in the lot fed cut bone; 2 fowls in this lot died and 1 was killed owing to a disjointed leg. Only 0.27 oz. of bone was fed per hen daily. The author found it impossible to feed a larger amount without serious bowel trouble. The principal results of the test are shown in the following table:

Animal meal vs. cut bone for egg production.

	Food consumed.		Cost of food per day per fowl.	Number of eggs produced.	Weight per egg.	Cost of food per egg
	Lbs.	*Ozs.*	*Cent.*		*Ozs.*	*Cents.*
Lot 1 (cut bone)	621	8	0.35	728	1.95	1.14
Lot 2 (animal meal)	640	11	.33	812	1.98	1.04

A test of the quality of the eggs raw and boiled was made. The eggs from the fowls fed animal meal were inferior in color and flavor to the others. From this test and those previously reported the following conclusions are drawn:

> "We have now carried through 5 experiments, comparing these 2 feeds. Two have given results slightly favorable to the bone in number of eggs; one a similar result in favor of the animal meal; and 2, the two last, which have been the most perfectly carried out, have been most decisively favorable to the animal meal. The latter has also been found the safer food. The greatly preponderating weight of the evidence afforded by these experiments, which have been most carefully conducted, is therefore in favor of the animal meal."

Narrow vs. wide rations for egg production (pp. 93–98).—Two trials are reported. In both the nutritive ratio for lot 1 was narrow and that for lot 2 wide. The first trial (in the winter) began December 12 and closed April 30; the second (in the summer) began May 1 and closed October 4. In both trials the 2 lots were fed wheat, oats, bran, animal meal, and green food (cabbage and cut clover in winter and lawn grass in summer). In addition in the first test lot 1 was given middlings and gluten feed and lot 2 corn meal and corn, the nutritive ratio for the 2 lots being 1:4.7 and 1:5.6, respectively. In the second trial lot 1 was given middlings in addition to the foods mentioned above and lot 2 corn meal and corn. Both lots received some gluten feed also. The principal results of the 2 tests are summarized in the following table:

Influence of narrow vs. wide rations on egg production.

	Food consumed.		Cost of food per day per fowl.	Number of eggs produced.	Weight per egg.	Cost of food per egg.
Test 1 (winter):	*Lbs.*	*Ozs.*	*Cent.*		*Ozs.*	*Cent.*
Lot 1 (narrow ration)	638	5	0.33	860	1.98	0.99
Lot 2 (wide ration)	566	5	.26	1,071	1.95	.61
Test 2 (summer):						
Lot 1 (narrow ration)	545	0	.32	859	1.98	.88
Lot 2 (wide ration)	594	8	.26	1,095	1.90	.61

In both trials the health of the fowls remained good, with the exception that in the second test one of the hens in lot 1 was sick for a few days. At the close of the test the condition of the plumage of the fowls was judged by an expert. They were then slaughtered. The principal conclusions follow:

"The hens on the wide (rich in corn) ration laid a great many more eggs in both the winter and in the summer experiments than those on the narrower ration.

"The difference in favor of the wide ration amounts to 25 per cent in the winter trial and to 33⅓ per cent in the summer trial, upon the basis of equal number of hen days.

"The total cost of feeds was less for the wide ration and of course the cost per egg was much less. In the production of 100 doz. eggs the saving on the basis of our winter test would amount to $4.56; on the basis of the summer test to $3.24.

"In average weight of the eggs produced there is a small difference in favor of the narrow ration, but in quality the weight of family evidence shows the egg produced by the corn-fed hens to have been somewhat superior. They were deeper yellow and of a milder flavor than the eggs from the narrower ration.

"The fowls on the wide ration gained somewhat in weight and were heavier at the close of the experiment than the others, notwithstanding the much larger number of eggs laid. . .

"The average weights before and after dressing were as follows: Narrow-ration fowls 5.07 lbs., dressed weight 4.37 lbs.; wide-ration fowls 5.44 lbs., dressed weight 4.81 lbs. The narrow-ration fowls gave 86 per cent dressed weight; the others, 88 per cent. The dressed fowls were judged by a market expert who pronounced the corn-fed fowls slightly superior to the others.

"The results are thus greatly in favor of the ration richer in corn meal and corn; and so important will a knowledge of this fact prove (if confirmed by further trials), because of the cheapness of these foods as compared with wheat, that the experiment is being repeated this year with 3 different breeds of fowls, using corn more largely than last year."

The influence of the cock on egg production (pp. 98–101).—Two tests of the influence of the cock on egg production were reported. These tests were made with the fowls used in the test mentioned above on the effect of condition powder and cut bone on egg production. In each test 2 lots of 16 fowls each were used. In both cases a White Leghorn cock was placed with lot 1. Experimental conditions were the same in both tests. The fowls were fed wheat, oats, bran, gluten feed, and animal meal. The principal conclusions are shown in the following table:

Influence of the cock on egg production.

	Food consumed.		Cost of food per day per fowl.	Number of eggs produced.	Weight per egg.	Cost of food per egg.
	Lbs.	*Ozs.*	*Cent*		*Ozs.*	*Cent.*
Test 1:						
Lot 1 (with cock)	404	0	0.29	631	1.96	0.88
Lot 2	400	0	.31	630	1.95	.87
Test 2:						
Lot 1 (with cock)	385	12	.30	629	1.98	.83
Lot 2	364	4	.30	526	1.97	.93

In both tests the health of the poultry remained good. The author's conclusion was that the cock was without apparent influence upon egg production.

> "In one respect only is there agreement in the results of the 2 trials; the average weight of the eggs from the hens with which a male was kept was slightly the greater in both trials. It seems not impossible that this effect may be due to the fact that the eggs had been fertilized. The difference, however, is exceedingly small and would be wholly without significance to the producer of eggs for market or for table use."

Banana flour (*Dietet. and Hyg. Gaz., 15 (1899), No. 11, pp. 648, 649*).—A brief note on the subject.

Vichka seed as a famine food, A. H. CHURCH (*Agr. Ledger, 1899, No. 1 (Veg. Prod. ser., No. 46), pp. 3*).—The composition of Vichka seed (*Cyanotis axillaris*) is reported and its food value discussed.

Ragi tailings as a prison food in the Madras Presidency, A. H. CHURCH (*Agr. Ledger, 1899, No. 4 (Veg. Prod. ser., No. 49), pp 5*).—The composition of ragi tailings (the outer seed coat of millet, *Eleusine coracana*) is reported and its food value discussed.

Report on prison dietaries, J. C. DUNLOP (*Glasgow: James Hedderwick & Sons, 1899, pp. 134*).—The report is an exhaustive study of prison dietaries in Scotland, with suggestious for reform. An appendix contains notes on the Scottish poorhouse dietaries and prison dietaries in other countries.

The equipment of camps and expeditions, C. H. SNOW (*Pp. 31, table 1; reprinted from Trans. Amer. Inst. Mining Engineers, 1899*).—A paper read before the American Institute of Mining Engineers at a meeting held in New York in February, 1899. Among other things the author discusses the food requirements of persons engaged in various expeditions in regions where there is little or no local food supply. Different condensed and prepared foods are described and a number of rations made up of such foods are suggested.

The danger of formaldehyde adulteration (*British Food Jour., 1 (1899), No. 10, p. 297*).—Remarks on the action of weak solutions on gelatinous and albuminous substances in retarding digestion, etc.

A new respiration calorimeter and experiments on the conservation of energy in the human body, W. O. ATWATER and E. B. ROSA (*Phys. Rev., 9 (1899), Nos. 3, pp. 129–163, figs. 12; 4, pp. 214–251, figs. 2*).—This apparatus has been described in another publication (E. S. R., 9, p. 863; 11, p. 372).

The food value of sugar (*Beet Sugar Gaz., 1 (1899), No. 7, pp. 15, 16*).—The article is based on a paper read by F. Strohmer at the recent annual meeting of the Central Association of the Beet Sugar Industry of Austro-Hungary.

Nutritive value of maize, R. LOPEZ Y PARRA (*Bol. Soc. Agr. Mexicana, 23 (1899), No. 36, pp. 710–713*).—A general article, pointing out the value of maize for Mexico.

The food value of olive-oil cake, M. DYBOWSKI (*Bul. Soc. Nat. Agr., France, 59 (1899), No. 7, pp. 510–518*).—The composition of olive-oil cake is reported, as well as tests of its feeding value for domestic animals. It was found to be a satisfactory food for pigs when combined with maize. Satisfactory results were not obtained with other animals.

Comparative feeding value of hay and alfalfa, MÜNTZ and GIRARD (*Jour. Agricole [Paris], 10 (1899), No. 111, pp. 112–116*).—A discussion embracing the chemistry, composition, and digestibility of alfalfa and hay, based upon experiments previously reported (E. S. R., 10, p. 379).

Experiments with salt-marsh hay, J. B. LINDSEY ET AL. (*Massachusetts Hatch Sta. Rpt. 1898, p. 42*).—Brief reference is made to the experiments with salt-marsh hay reported in a previous publication (E. S. R., 10, p. 472).

Poplar leaves for feeding animals, C. SARCE (*Belg. Hort. et Agr., 11 (1899), No. 18, pp. 274, 275*).—The successful feeding of poplar leaves in time of drought is noted.

The making of silage, STUTZER (*Fühling's Landw. Ztg., 48 (1899), No. 20, pp. 745–749*).—A general discussion.

The reputed value of alcohol as a protector of protein, R. ROSEMANN (*Arch. Physiol. [Pfluger], 77 (1899), No. 7–8, pp. 405–424*).—A controversial article.

Investigations on the use of beets in feeding animals, L. BRETIGNIERE and DU PONT (*Ann. Agron., 25 (1899), No. 6, pp. 257–281, fig. 1*).—The yield and composition of tankard, collet rose "rich," and collet rose "intermediate" beets is reported, as well as feeding experiments with sheep in which these beets constituted a considerable part of the ration.

The freezing of feeding stuffs (*Landw. Wchnbl. Schleswig-Holstein, 49 (1899), No. 43, pp. 791–793*).—This article, taken from the *Landwirtschaftliche Zeitung für Westfalen und Lippe,* discusses the chemical changes produced in potatoes, beets, and other feeding stuffs by freezing, quoting the work of a number of investigators.

The formation of sugar from protein, R. COHN (*Ztschr. Biol., 28 (1899), No. 1–2, pp. 211–218*).—Experiments with rabbits are reported which, in the author's opinion, show the formation of glycogen from leucin.

New investigations on the heat of formation and combustion of various nitrogenous and other compounds, M. BERTHELOT and G. ANDRÉ (*Compt. Rend. Acad. Sci. Paris, 128 (1899), No. 16. pp. 959–971*).—The bodies used include cholesterin, xanthin, nicotin, indol, etc.

Two new reactions for distinguishing between peptic and pancreatic digestion, V. HARLAY (*Jour. Pharm. et Chim., 6. ser., 9 (1899), pp. 468–470*).

The relation of the composition of the ash of young guinea pigs to the ash of the milk they have consumed, E. ABDERHALDEN (*Ztschr. Physiol. Chem., 27 (1899), No. 4–5, pp. 356–367*).

The relation between rapidity of growth and composition of milk consumed in nursing dogs, pigs, sheep, goats, and guinea pigs, E. ABDERHALDEN (*Ztschr. Physiol. Chem., 27 (1899), No. 4–5, pp. 408–462*).—This is a continuation of a previous investigation.[1]

The cattle of Kumaon, G. K. WALKER (*Agr. Ledger, 1899, No. 7 (Veg. Prod. ser., No. 28), pp. 7*).—The appearence, characteristics, and the suitability of these native

---

[1] Ztschr. Physiol. Chem., 26, No. 5, p. 487.

Indian cattle for dairy purposes and as draft animals are discussed as well as their feeding, care, breeding, etc. They are said to resemble in appearence the Kerry-Dexter cattle of Great Britain and Ireland.

Measuring cattle, P. CAGNY (*Prog. Agr. et Vit., 16 (1899), No. 36, pp. 286–291, figs. 5*).—A method of measuring the external conformation of cattle.

Fattening sheep for freezing (*Agr. Gaz. New South Wales, 10 (1899), No. 9, p. 901*).—A note on the successful and profitable fattening of sheep on such crops as pumpkins, prairie grass, alfalfa, and rape in New Zealand. The mutton is kept for shipment in cold storage.

Horse feeding (*An. Soc. Rural Argentina, 34 (1899), No. 5, pp. 142, 143*).—The subject is discussed with reference to local conditions.

Annual reports of the poultry associations of the Province of Ontario, 1898, (*Ontario Dept. Agr., 1899, pp. 68, fig. 1*).—In addition to the usual statistics this bulletin contains a number of articles on poultry and poultry raising by different contributors.

Poultry raising from an English standpoint, F. HOOD (*Fühling's Landw. Ztg., 48 (1899), No. 20, pp. 749–753*).—A popular article.

Egg production, L. C. VERRY (*Jour. British Dairy Farmers' Assoc., 14 (1899), pt. 1, pp. 21–29*).—A general discussion with special reference to English conditions. Many statistics are quoted.

Poultry feeding, A. DE VILLÈLE (*Rev. Agr. Réunion, 5 (1899), No. 8, pp. 353–357*).—A general article quoting recent work and discussing local conditions.

Foods for poultry (*Jour. Jamaica Agr. Soc., 3 (1899), No. 10, pp. 574–577*).—Discusses the subject with reference to local conditions.

The influence of freezing on the development of the embryo in hen's eggs, E. RABLAUD (*Compt. Rend. Acad. Sci. Paris, 128 (1899), No. 19, pp. 1183–1185*).—Low temperature produced marked changes in the embryo. When the eggs hatched, monstrosities were numerous.

DAIRY FARMING—DAIRYING.

Experiments to ascertain the effect of different amounts of protein upon the cost and quality of milk, J. B. LINDSEY ET AL. (*Massachusetts Hatch Sta. Rpt. 1898, pp. 42, 43*).—A brief preliminary report on 2 experiments with 12 cows, made to study the effect of rations containing 1.5, 2, and 2.5 lbs. of digestible protein. The total amount of digestible nutrients was the same in each of the 3 rations. The first experiment lasted 9 weeks and the second 4 weeks.

"About 5 per cent more milk was produced on 2 lbs. and 10 per cent more on 2.5 lbs. of protein daily, than when the animals received 1.5 lbs. each. The quality of the milk was scarcely changed. . . .

"It is believed that a continuous feeding of 2 or 2.5 lbs. of protein daily tends, to some extent, to develop the milk-producing capacity of the cow. . . .

"The writer is of the opinion that animals weighing from 800 to 1,000 lbs., producing from 10 to 15 qts. of milk per day, should receive about 2.5 lbs. of digestible protein and 15 to 16 lbs. of total nutrients daily. This is in accordance with Wolff's rations. When protein is costly, it might be advisable to reduce the amount to 2 lbs. daily."

On the composition of the milk yielded morning and evening by cows at Glasneven government agricultural institutions, C. A. CAMERON (*British Food Jour., 1 (1899), No. 6, pp. 168, 169*).—The data were secured in connection with an experiment on the economy of flaxseed *vs.* linseed cake for milch cows, not yet completed. The yield and composition of the milk of each of 8 cows is given for 6 days during April. The mean composition of the milk of the 8 cows for the 6 days was as follows: Morning—total solids, 12.1; solids-not-fat, 9.2; fat, 2.9 per cent; evening—total solids, 13.88; solids-not-fat, 9; fat, 4.88 per cent.

> "In the 48 specimens of morning's milk the nonfatty solids never were so low as 8.5 per cent, the minimal standard, while in 18 of the specimens the fats were below the minimal standard of 2.75 per cent.
>
> "In the 48 specimens of evening's milk the solids-not-fat never sank below the minimal standard, but in 18 instances they were less than 9 per cent.
>
> "It will be seen, then, so far as these 96 specimens of milk are concerned, the standard of 8.5 per cent of nonfatty solids holds good; but that the standard for fats fails in the case of the morning's milk. The morning's milk was rich in nonfatty solids and poor in fats, while the evening's milk was rather poor in nonfatty solids and very rich in fats. In some instances the percentage of fat was more than twice as large in the evening's milk as in the morning's.
>
> "There was only 8 hours' interval between the times of milking; if the interval were longer, the difference between the morning's and evening's milk might not be so great."

The animals were fed for 2 weeks on rations which "seem to have been insufficient." The cows lost in weight, and in some cases there was a slight shrinkage in yield of milk, but the composition remained practically unchanged, indicating that "it is the flesh of the animals that first declines when the aliment is insufficient."

The acidity of milk, A. L. TOURCHOT (*Abs. in British Food Jour., 1 (1899), No. 7, p. 199*).—The author advocates the determination of acidity in addition to the chemical composition. In order to ascertain the average acidity of fresh milk he examined a large number of samples of known origin. The acidity was found to be fairly constant in milk under 12 hours old, from 1.4 to 1.6 cc. of decinormal soda solution being required to neutralize 10 cc. of milk.

> "The normal quantity being placed at 0.126 to 0.144 per cent lactic acid, a weaker acidity indicates watering, or a milk consisting partly of cream. A greater acidity than the foregoing figures may be caused by the milks being too old or unclean, or having been derived from freshly-calved cows. With regard to milk from the latter source, the observations tend to show that it possesses a higher acidity than ordinary milk (sometimes reaching 1.8 cc. deci-normal soda, for 10 cc. milk), and that this high acidity continues for 2 weeks after calving, such milk still retaining its peculiar odor. . . . If its acidity when sold exceeds a certain degree—say 1.7 cc. deci-normal soda to 10 cc. milk in summer, when the cows are on pasture, and 1.6 when being stall-fed—it should be rejected as unfit for food. . . . If, on the other hand, the acidity falls below 1.2 in winter and 1.4 in summer, it is an indication of a fraudulent addition of water, or of the presence of an unhealthy cow in the herd, which, of course, renders the milk unfit for food. These figures are the mean results of observations for Canada."

Properties of galactase, a digestive ferment of milk, S. M. BABCOCK, H. L. RUSSELL, and A. VIVIAN (*Wisconsin Sta. Rpt. 1898, pp. 77–86*).—Previous experiments (E. S. R., 10, p. 785) to determine the properties of a digestive ferment in milk, for which the name galactase is proposed, have been repeated on a more extended scale, and a preliminary report of the work, including methods and results, is given. Galactase is considered as allied in some respects to trypsin, and possesses in common with other enzyms the property of attaching itself to finely divided particles in suspension. Accordingly it occurs in larger proportions in cream and in separator slime than in milk. Concentrated extracts of galactase were prepared from separator slime. It rapidly decomposes hydrogen peroxid. As shown by digestion experiments in milk, the proteolytic action was greater at a temperature of 37 to 42° C. than above or below this range. Heating for 10 minutes at 71° C. reduced its action, and heating for 10 minutes at 76° C. destroyed the ferment.

Enzym solutions $\frac{1}{10}$ and $\frac{1}{25}$ normal alkaline, neutral, and $\frac{1}{10}$ normal acid were used in digestion experiments in gelatin. The neutral or slightly alkaline reaction was most favorable to liquefaction, the decinormal solutions of acid and alkali retarding it. Tested by Fermi's method, none of these solutions after being heated at 65 to 80° C. for from 10 to 60 minutes showed any liquefying action on gelatin. As determined by Storch's test (E. S. R., 10, p. 384), hydrogen peroxid was decomposed in the neutral and alkaline gelatin when the temperature of heating did not exceed 75° C. for 60 minutes or 80° C. for 10 minutes.

Galactase is destroyed by mercuric chlorid, formalin, phenol and its derivatives, and carbon bisulphid. Chloroform was found the most satisfactory antiseptic in milk which would still permit the action of the enzym. Decomposition products formed by galactase are similar to those formed in tryptic digestion.

Distribution of galactase in cow's milk, S. M. BABCOCK, H. L. RUSSELL, and A. VIVIAN (*Wisconsin Sta. Rpt. 1898, pp. 87-92*).—The quantity of galactase in the milk of 5 cows as measured by the amount of soluble proteids formed was determined at different periods of lactation. The results are tabulated, and show but "little difference during the advancing period of lactation, the milks taken at different periods varying in no regular manner." The amount of soluble proteids, however, was slightly increased during the beginning of the colostrum period as compared with the normal milk of the same animal. This difference increased with the age of the sample, indicating a more rapid digestion of proteids in colostrum milk. Milk from 7 cows at the same stage of lactation treated with 5 per cent chloroform and kept at an approximately uniform temperature was analyzed at different times for 6 months. The results are tabulated and shown in a diagram. In the fresh milk the nitrogen in soluble form ranged from 0.04 to 0.05 per cent, or 8 to 10 per cent of the total nitrogen present. "The progressive formation of soluble nitrogenous compounds as the milks increase in age is strikingly apparent."

Distribution of galactase in different species of Mammalia, S. M. BABCOCK, H. L. RUSSELL, and A. VIVIAN (*Wisconsin Sta. Rpt.*

1898, pp. 93–97).—A study similar to the above was made with human milk and milk from the cow, sheep, goat, sow, mare, burro, and grade buffalo. Analyses of the milks when fresh and at different intervals are tabulated. Diagrams show the percentage of soluble nitrogenous products in the various milks and the percentage of total nitrogen in soluble form for 6 months. "The results show that the presence of a proteolytic ferment is not confined to cow's milk, but is found in the milk of all species of animals which we have examined." No relation was discovered as existing between the action of galactase and the maternal function.

The antiseptic value of certain chemicals in milk, S. M. BABCOCK, H. L. RUSSELL, and A. VIVIAN (*Wisconsin Sta. Rpt. 1898, pp. 98–103*).—In connection with investigations on the enzyms in milk, a study was made of the antiseptic value of a number of chemicals which have been considered as acting upon organized ferments without materially affecting the unorganized ferments or enzyms. The following chemicals were used in 2 series of experiments with milk of 0.08 and 0.11 per cent acidity: Benzol, chloroform, ether, toluol, xylol, anilin, arsenious acid, oil of origanum, thymol, sodium fluorid, phenol, sodium chlorid, oil of cloves, oil of cassia, oil of Ceylon cinnamon, turpentine, and oil of mustard. The results are tabulated, from which "it is evident that there is a marked discrepancy between the ability of these substances to prevent bacterial changes in milk and their reputed efficiency as antiseptics." This is explained on the theory that they form insoluble compounds with the butter fat, thus lessening their antiseptic properties. The efficiency of 2 antiseptics was similarly diminished in experiments in which olive oil was added to bacterial cultures.

"Of the number of different chemicals tested, only 4, viz., chloroform, ether, benzol and toluol, are to be recommended in studying these inherent enzyms.

"With these 4 antiseptics, distinction should be made between the curdling and the proteolytic action. Ether retards the curdling of milk, while scarcely any difference exists in the time of curdling with the other 3 antiseptics. This effect alone suggested to us the possibility of a curdling enzym in milk that was different from the digesting ferment.

"All of these substances undoubtedly exert some repressing action on the proteolytic changes. Small increments in the amount of antiseptics employed, indicates, almost without exception, that a retardation in the rate of digestion took place. This is especially marked in the case of chloroform where a variation from 5 to 12 per cent diminished the amount of soluble products 17 per cent. Chloroform and ether seem to affect the digestive changes least of all. Chloroform is undoubtedly the best agent for work upon this enzym, as 2 to 3 per cent keeps milk perfectly. Also, on account of its high specific gravity, and its affinity for fat, the cream is thereby submerged, thus rendering possible more accurate sampling."

Effect of varying strengths of rennet extract in curdling milk, J. W. DECKER (*Wisconsin Sta. Rpt. 1898, pp. 31–34*).—Solutions were made of Hansen's rennet extract by diluting 5, 10, 15, 20, and 25 cc. of the strong commercial extract to 50 cc. A rennet test was made with each of these solutions in which 5 cc. was used to coagulate 160 cc. of the same milk at 86° F. The Monrad rennet test was used. The time required for coagulation with the solution of 5 cc. in 50 was 90 seconds. Assuming the time required for coagulation to vary inversely as the strength of the solution, the time required with the other solutions should have been 45, 30, 22, and 18 seconds, respectively. The actual time required, however, was 51, 41, 32, and 28 seconds, respectively. The power of the rennet extract was, therefore, not proportional to the degree of the dilution. Similar results were obtained in 4 series of experiments in curdling larger quantities of milk in a cheese vat.

"Viewing the results obtained practically, we must conclude that the usual method of comparing the money values of 2 brands of rennet extract, in which these values are considered as proportioned to the times required in an ordinary rennet test, is not correct. The relative amounts of the extracts required to coagulate the same quantity of the same milk, at 86° F., should determine their relative money values."

The action of rennet in watered milk, J. W. DECKER (*Wisconsin Sta. Rpt. 1898, pp. 35, 36*).—Two experiments are reported. These were conducted with the Monrad rennet test (in which 5 cc. of the commercial rennet extract is diluted to 50 cc. and 5 cc. of this dilute solution used to coagulate 160 cc. of milk at 86° F.). In the first experiment 96 seconds were required to coagulate undiluted milk, and 345 seconds to coagulate the same milk diluted one-half with water. In the second experiment with milk diluted one-half, one-third, one-fourth, and one-fifth, the time required for coagulation was 21 seconds for the undiluted milk, and for the diluted 35, 26, 23, and 22 seconds, respectively. "The time of coagulation is shown by these experiments to be increased by the addition of water to milk, but the amount of such adulteration in a factory would probably not be enough to make a noticeable difference."

Relative absorption of odors in warm and cold milk, H. L. RUSSELL (*Wisconsin Sta. Rpt. 1898, pp. 104–109*).—The following method was employed in several series of experiments to determine the relative absorption of different odors by warm and cold milk.

"A large box with a tight-fitting cover was taken and in the bottom of the same were placed 2 jars, one filled with warm water and the other with ice or cold water. On the surface of each receptacle was then placed a basin filled with milk. The relatively large body of warm and cold water maintained the respective milk samples at temperatures above and below that of the surrounding air. In the bottom of the box was then placed samples of various substances that were to be tested as to their odor-yielding properties. In passing judgment on the relative absorption of odors, the samples of milk that had been exposed were placed in glass bottles and then brought to the same temperature, care being taken to thoroughly mix the samples so that no physical difference could be detected that would enable the scorers to recognize the respective samples as they tested them from day to day."

Trials were made with corn silage, horse manure, urine of cows, and the oils of cinnamon, wintergreen, and peppermint. The results on the whole are considered as showing that, contrary to general belief, warm milk absorbs odors more rapidly than cold. The relative absorption of the different odors is discussed. Peppermint was absorbed the most readily.

On the use of boric acid and formic aldehyde as milk preservatives, S. Rideal and A. G. R. Foulerton (*Public Health, 11 (1899), No. 8, pp. 554–568*).—From experiments made by Thomson and by the authors the latter fix the minimum quantity of these preservatives sufficient to preserve milk for 24 hours at not less than 1 part in 50,000 of formaldehyde, and not less than 35 grains per gallon (0.05 per cent) of a mixture of boric acid and borax. They report experiments on the effect of boric acid and formaldehyde on artificial digestion, using different amounts of the preservatives, from which they conclude that—

> "Neither boric acid mixture in the proportion of 1 in 2,000, nor formaldehyde 1 in 50,000, has any appreciable effect on the proteolytic action of the peptic and pancreatic enzyms. The amylolytic action of saliva is distinctly retarded by the boric acid mixture, but to a much less extent by formaldehyde. It must, however, be borne in mind that salivary digestion does not exist in infants, and has possibly only a minor importance in the metabolic economy of adults.
>
> "Taka diastase is interesting as being a mold ferment, and because of the marked influence which the boric acid mixture has on retarding its amylolysis.
>
> "The preservatives have no marked effect on the digestibility of the food after contact for 20 to 24 hours prior to the action of the enzym."

The effect of formalin of different strengths on 3 kittens, a rabbit, and 2 guinea pigs was studied for periods covering nearly a month and a half. The authors conclude from these experiments that "formaldehyde in quantities necessary for the preservation of milk has no marked effect upon proteid metabolism, as evidenced by the variation in weight of the animals experimented on, or by waste of ingested nitrogen."

The authors mention that fish were not noticeably affected by being kept in water containing 1 part of formaldehyde in 50,000 for 6 days, changing the water daily, and that frogs suffered no apparent inconvenience from being kept for 2 hours in a solution of 1 part in 20,000.

> "We therefore are of the opinion that, so far as our present knowledge is concerned—
>
> "(1) Boric acid in the proportion of 1 in 2,000 and formaldehyde in the proportion of 1 in 50,000 are effective preservatives for milk for a period of 24 hours;
>
> "(2) That these quantities have no appreciable effect upon digestion;
>
> "(3) That these quantities have no appreciable effect upon the digestibility of foods preserved by them; and
>
> "(4) That formaldehyde in the above proportion, so far as our investigations have extended, does not appear to have any injurious action upon animal tissues or on nutrition."

The use of boric acid and formaldehyde as food preservatives, O. Hehner (*British Food Jour., 1 (1899), No. 5, p. 132*).—This is a criticism of conclusions 2, 3, and 4 in the above article. It is claimed that the author's own figures show, in nearly every case, an inhibiting influence on digestion of both the boric acid and the formaldehyde in the proportions recommended, although usually small. The experiments with animals are criticized on the ground that there were no control animals with which the gains of the subjects could be compared, and from the results as stated the critic is inclined to infer that the preservatives added to the diet had a depressing and injurious influence upon assimilation.

The effect of pressure in the preservation of milk, B. H. Hite (*West Virginia Sta. Bul. 58, pp. 15-35, figs. 6*).—This is a preliminary report on investigations to determine the effect of pressure in the preservation of milk, and contains the details and results of a large number of experiments.

The general method employed was as follows: A sample of milk was inclosed in a collapsible tin tube, placed in a hollow steel cylinder, the remaining space in the cylinder being filled with water, and subjected to hydraulic pressure applied to a piston fitted to the cylinder. The different pieces of apparatus employed in the progress of the work are described and in some cases figured. A 100-ton hydraulic press was used. Considerable difficulty was experienced in obtaining cylinders that would withstand the higher pressures.

Several hundred samples of milk in all were subjected for various length of time to pressures ranging from a few hundred pounds to 100 tons. In every experiment a duplicate sample received the same treatment, except pressure, and the results in the 2 cases are compared.

In the experiments carried on at room temperature, pressures lower than 10 tons to the square inch did not materially delay the souring of milk as compared with check samples. Milk subjected to pressures of 10 to 15 tons for 2 weeks was sweet at the end of the test. Pressures of 30 tons for 1 hour delayed the souring of milk 24 hours, and pressures of 70 to 95 tons for from 5 minutes to 1 hour delayed souring 2 to 7 days. "The best results from a practical standpoint were doubtless those obtained with pressures of 10 to 15 tons for as many days."

In a number of experiments the samples of milk enclosed in the cylinders were kept at temperatures of 140 to 170° F. for 5 minutes to 4 hours by means of a water bath. Pressures of 5 to 20 tons in these tests gave much better results than corresponding pressures at lower temperatures. In one test several tubes were filled with milk that had been allowed to remain in a loosely covered can all day. These samples were subjected to pressures of 7 to 12 tons at temperatures of 152 to 160° F. for 1 to 3 hours. After being kept at the room temperature for 10 days a number of the samples were opened and found to be sweet. Six of the remaining samples were shipped to New York City and back, after which 2 were opened, and these and the other samples opened later were sweet.

"The results obtained by the use of pressure alone would seem to indicate that in the usual method of heating milk to temperatures above the boiling point of water the slight pressure developed at these temperatures would of itself fall far short of sterilizing the milk. It would also appear that by using much higher pressures (10 tons) sterilization may be effected at much lower temperatures."

In none of the experiments were the bacteria in the milk found to be completely destroyed by pressure. While the souring of the milk was prevented in many cases, other changes were sometimes indicated by a "musty" odor or a change in color. Germs of anthrax, typhoid fever, tuberculosis, and bubonic plague and *Proteus vulgaris*, which had been added to the milk, were not killed by pressures of 10 to 15 tons for 8 days. The pathogenic germs were found more resistant to pressure than those concerned in the souring of milk.

Provision is being made at the station for continuing the experiments with larger quantities of milk.

On butter and some changes in the same, J. HANUŠ (*Listy Chemické, 23 (1899), pp. 27, 67; abs. in Chem. Ztg., 63 (1899), No. 68, Repert., p. 257*).—The author examined 25 samples of butter sold in Prague and made in the mountains, Hohenelbe, etc. The following range was observed: Acid number—unmelted butter 2.56 to 20.82, melted butter 2.57 to 20.18; Reichert-Meissl number, 24.03 to 31.57 (average, 26.69); saponification number, 223 to 235.3 (average, 227.4); Hehner number, 85.26 to 92.34 (average 87.9); iodin number, 29.6 to 43.36 (average 36.05); water, 11.02 to 29.71 per cent; ash, 0.09 to 0.18 (including salt 1.82) per cent; fat, 64.66 to 85.34 per cent; milk sugar and casein, 1.94 to 6.39 per cent; specific gravity at 100° C., 0.867 to 0.868. The ash content is regarded as very low.

The author studied the possibility of estimating the rancidity from the amount of free volatile acids, but with negative results. In the process of becoming rancid the glycerids of the higher insoluble fatty acids seemed to be decomposed much more rapidly than the glycerids of the acids of lower molecular weight.

Under the influence of air and light the saponification equivalent and the acid number of butter fat increased, the iodin number decreased, and the Reichert-Meissl number was not materially changed. From the data obtained the author concludes that lactone is formed from the unsaturated fatty acids by the action of air. Butter subjected to the action of light and air gradually lost its yellowish color, becoming lardy in appearance, smelled very rancid, and had a sharp, tallowy taste.

The properties of some butter kept in a moist room for 4 months, until it became covered with mildew, are described. The action of the mildew caused a different change from that of light and air. In this case only the glycerids of the saturated acids were decomposed, those especially of lower molecular weight being apparently fully oxidized, while the unsaturated acids were practically unchanged. A small amount of aldehyde was formed, probably through oxidation of oleic acid.

Investigation on the effect of salt (NaCl) on rennet action, J. W. DECKER (*Wisconsin Sta. Rpt. 1898, pp. 37–41*).—Several investigations were carried on during the year to determine the influence of common salt on rennet action. Milk was diluted with different proportions of brine containing 15 per cent of salt. The rennet test of the undiluted milk was 30 seconds and of the same milk diluted with 9, 10, 11, 12.5, 14, and 16.7 per cent of brine was 135, 155, 200, 210, 230, and 310 seconds, respectively. The rennet test of milk diluted with 25 per cent of water was 21 seconds, and of milk diluted with 25 per cent of brine containing 1 per cent of salt was 34 seconds. This retarding effect of salt upon the action of rennet was also shown by adding salt directly to the milk. The addition of 5 per cent of salt to the milk stopped coagulation entirely and smaller quantities hindered it greatly.

"If only the usual amount of rennet is used and salt is added to the milk, we will get the effect of adding too little rennet, namely, a slow-curing and very likely a corky cheese. It is therefore our opinion that salt should not be added to milk that is to be made into Cheddar cheese, and for brick cheese it will be preferable to add the salt to the curd and not to the milk."

Rennet test solutions made up with water and with 5 per cent of brine required in one trial 20 and 31 seconds, respectively, to coagulate 160 cc. of milk, and in another trial 22 and 28 seconds. Chemical analyses of 4 commercial rennet extracts showed a salt content ranging from 16.04 to 17.21 per cent. In studying the effect of salt used in extracts as a preservative, an extract was prepared free from salt, which gave a rennet test of 35 seconds. The addition of salt to this extract reduced its coagulable power, 40 seconds being required when 5 per cent of salt was added, and 52 seconds when 20 per cent was added. Boric acid and formalin in the milk also retarded the action of the rennet. Rennet tests were made using a salt-free extract and milk diluted one third, one-half, and three-fourths with water. As with commercial extracts the power of the rennet was increased with the dilution, and it is therefore concluded that "the phenomenon of an increased proportional curdling power of dilute rennet extracts is independent of the salt that may be in the extracts."

Method of handling sour milk in making cheese, J. W. DECKER (*Wisconsin Sta. Rpt. 1898, pp. 42–44*).—Milk containing 0.25 to 0.32 per cent of lactic acid was used in 4 comparisons of firming curds in water and by stirring on racks. The data are tabulated and show that 2 per cent of fat and from 0.108 to 0.144 per cent of lactic acid were washed out in the water used in firming.

"Several batches of cheese made on the same days by the 2 methods of handling, were kept together for 2 months in the curing room The cheese in which the acid was washed out by water developed ragged gas holes, and a flavor similar to cheese which is made up in summer without developing acid before pressing, and afterwards kept in a warm curing room. The cheese in which the whey was expelled by stirring was close in texture and of a very good flavor."

A study of dairy salt, F. W. WOLL (*Wisconsin Sta. Bul. 74, pp. 45, pls. 5, fig. 1*).—The author presents in tabular form chemical and mechanical analyses of 81 samples of dairy salt, with a discussion of the data; gives the results of a number of experiments in salting butter; outlines the methods of manufacture, and discusses the comparative value of the Ashton, Diamond Crystal, Genesee, Vacuum Pan, and Worcester brands of dairy salt; and discusses, among other topics, the production of dairy salt, ideal butter salt, the use of salt in butter making, composition of salted and unsalted butter, salt as a butter preservative and as a flavor producer, and the use of salt in cheese making.

The samples analyzed included 55 domestic and 25 foreign dairy salts, representing in all 37 brands. In the author's discussion of results, it is stated that—

> "The leading brands of [American] dairy salt in general contain 98 to over 99 per cent of pure sodium chlorid, 0.5 to 1.5 per cent calcium sulphate, 0.1 to 0.5 per cent calcium chlorid, a trace of 0.2 per cent magnesium chlorid, none to 0.3 per cent moisture, and none to below 0.1 per cent of insoluble impurities. . . . If we compare the analyses of domestic and foreign dairy salts, we are at once struck by the great variations in the composition of the latter salts, and also by the fact that the leading brands of our American dairy salts are equally pure, and in some cases purer than any brands which rank highest in foreign dairy countries."

Of the American salts, 41 showed a content of pure sodium chlorid above 98 per cent, while of the foreign salts only 13 came above that limit.

The mechanical examination consisted of determinations of the size of grain, apparent specific gravity, and relative rate of solubility of the different samples. The water absorbing power of salt was shown by experiment to increase with the content of calcium and magnesium chlorids. Photo-micrographs of salt crystals of 24 leading brands are shown in plates.

In discussing the effect of the various brands of salt on butter, opinions from 13 butter judges, commission men, and creamery and cheese-factory companies, are quoted, from which it would appear that "no special brand stands first in all respects, but that there is in general a fair choice between several of our leading dairy salts."

A summary of a large number of analyses of salted and unsalted butter is given to show that the addition of salt lessens the water content of butter. In this connection analyses made by the author of 28 samples of foreign and 7 of American butter exhibited at the National Buttermakers' Convention, held in Sioux Falls, S. Dak., January, 1899, are given. The foreign butters were from 12 countries and showed a salt content ranging from 0.79 per cent (the average of 2 samples from France) to 2.86 per cent (the average of 7 samples from Ireland).

A summary of 12 comparisons of fine-grained and coarse-grained salt in butter making showed 1.8 per cent greater loss in weight of butter during working when fine-grained salt was used, with no marked difference in flavor of butter. The average composition of the 12 samples of butter in each series is given, and also of 8 samples worked on a Mason table worker and 12 worked in a Victor combined churn and worker.

How can New England compete with the West in dairying? J. L. HILLS (*Massachusetts State Bd. Agr. Rpt. 1898, pp. 156–181*).—In an address before a public meeting of the Massachusetts State board of agriculture the author pointed out the advantages possessed by eastern and western dairymen and offered suggestions for the meeting of western competition.

Forage and soil crops for dairy cows, T. SHAW (*Creamery Gaz., 24 (1899), No. 11, p. 6*).—A discussion of rye, mixed grains, and cowpeas for pasture, and oats and peas, alfalfa, soy bean, sorghum, and corn as soiling crops for dairy cows. It is believed that sugar-beet pulp can be fed more advantageously to cattle and sheep that are being fattened than to dairy cows.

Tests of dairy cows, J. W. DECKER (*Wisconsin Sta. Rpt. 1898, p. 30*).—The results of official tests of 10 cows made by the station for the Holstein-Fresian Association are tabulated.

Milk secretion of cows under the influence of rations rich in fat, F. FALKE (*Halle, 1898; abs. in Ztschr. Untersuch. Nahr. u. Genussmtl., 2 (1899) No. 2, p. 234*).—The author fed 2 cows with a mixture of meadow hay and fat-free rape cake, and in different periods added emulsions of sesame, cocoanut and almond oils in the form of drink. The fat contents of the milk increased in every case when the emulsified oils were given, but the yield of milk decreased.

(For effect of this feeding on the butter see E. S. R., 10, p. 685.)

Does a transmission of copper from food to milk take place? F. WIRTHLE (*Chem. Ztg., 23 (1899), No. 77, p. 803*).—Several samples of milk were examined which were of quite blue color and were believed by the senders to be colored by copper sulphate, as the cows producing them had been partially fed on clover which had been sprayed with that material. A slight trace of copper was found in one case and none whatever in the others. The food is not believed to have had any influence on the milk.

Influence of pasture land on the quantity and quality of milk, C. B. DAVIES (*Jour. British Dairy Farmers' Assoc., 14 (1899), pt. 3, pp. 217–223*).—A summary of answers received from dairymen to a list of questions bearing on this subject.

Analyses of milk in Holland, A. LAM (*British Food Jour., 1 (1899), No. 10, pp. 299–300*).—This is the report for 1898 of the official analyst at Rotterdam, giving the results of about 150 analyses arranged by months. For the year the total solids ranged from 11.20 to 13.64 and averaged 12.25 per cent; the fat ranged from 2.94 to 4.53 and averaged 3.62 per cent; and the milk sugar from 8 to 9.38, and averaged 8.63 per cent. The acidity (Soxhlet-Henkel) 20 hours after milking ranged from 3.2 to 4, averaging 3.65. The results are compared with the averages for 4 years past.

Milk and cream, J. B. LINDSEY (*Massachusetts State Bd. Agr. Rpt. 1898, pp. 346–368*).—A popular discussion of the formation and composition of milk, changes in milk due to bacteria, pasteurization, separation of cream, and methods of handling and marketing milk and cream.

Milk and milk preparations, A. HEUBNER (*Ztschr. Diätet. u. Phys. Ther., 3 (1899), No. 1, pp. 3–17*).

Goats for the supply of milk to cottagers, H. S. HOLMES-PEGLER (*Jour. British Dairy Farmers' Assoc., 14 (1899), No. 1, pp. 16–30*).—Gives the yields of milk by a number of goats, and remarks on composition and breeds.

A new process for the improvement of inferior butter (*British Food Jour., 1 (1899), No. 2, pp. 31, 32*).—A description of the Haines process, as employed by the Irish Aerated Butter Company.

Butter salt, TIEMANN (*Chem. Ztg., 23 (1899), No. 87, p. 942*).—In connection with a butter exhibition in Dresden, it was found that butter from Posen frequently had a bitter taste, which investigation showed to be due to an excessive amount of magnesia in the salt used. A subsequent examination of the dairy salt on the market showed that it was quite possible to procure salt suitable for use in butter making.

Formaldehyde as a milk preservative, A. G. YOUNG (*Sanitarian, 43 (1899), Dec., p. 524*).—In a paper read before the recent meeting of the American Public Health

Association the author concluded, as the result of an examination of all available literature on the subject, that formaldehyde used as a preservative tended at least to impair the nutritive value of milk; that the tendency was also to interfere with the digestive processes; and that it would be unwise and unsafe to encourage or to suffer the use of formaldehyde in the public milk supply even under any possible restrictive regulations.

The cause and prevention of infant mortality, E. WENDE (*Sanitarian, 43 (1899), Dec., pp. 522–524*).—In a paper read before the recent meeting of the American Public Health Association the author paid particular attention to the subject of milk supply. He believed that the whole system of milk supply from the dairy to the consumer should be under both State and municipal control. He advocated a rigid inspection of herds, sanitary conditions, food, etc., and other regulations which would insure proper and cleanly handling of milk.

Tuberculosis and the milk supply, G. M. WHITAKER (*Massachusetts State Bd. Agr. Rpt. 1898, pp. 339–345*).—A popular discussion.

Camembert cheese, G. E. LLOYD-BAKER (*Jour. British Dairy Farmers' Assoc., 14 (1899), No. 3, pp. 224–227*).—An account of visits to several farms in Normandy where this cheese is made.

VETERINARY SCIENCE AND PRACTICE.

Ticks and Texas fever, H. A. MORGAN (*Louisiana Stas. Bul. 56, 2. ser., pp. 127–141, pls. 9*).—This bulletin discusses from an anatomical and biological standpoint the cattle tick (*Boophilus bovis*), the lone star tick (*Amblyomma unipunctata*), the wood tick (*Dermacentor americanus*), and another species known as *Ixodes ricinus*.

The female of the lone star tick was observed to deposit from 3,230 to 6,519 eggs. Eggs were deposited during a period of nearly 2 months. A fully engorged female captured June 1 began laying eggs June 5. The eggs began hatching July 4 and the seed ticks were placed upon the animal July 16. On July 20 the ticks were much distended but began to disappear, just previous to the second molt. The author believes that the lone star ticks do not molt the second time upon cattle.

The wood tick was observed to deposit as many as 7,378 eggs. The author believes that this species is parasitic upon other animals during its first and second stages and is parasitic upon cattle only during its third stage. A number of experiments with the lone star tick and wood tick, in which they were placed upon susceptible cattle, demonstrated that they do not transmit the germs of Texas fever. So far as can be judged from actual experiments the cattle tick is the only species responsible for the transmission of the disease. The author recommends not only the usual cattle dips for the destruction of ticks upon cattle, but a rotation of crops and pasture lands in such a manner as to starve the ticks.

The Borna horse disease, F. A. ZÜRN (*Fühling's Landw. Ztg., 48 (1899), No. 11, pp. 417–421*).—This disease receives its name from the name of the town in which a large number of cases occurred. It has been shown to be caused by a coccus germ. The symptoms of the disease are yawning, sleepiness, hanging of the head, and a lack of appetite. At first there is no fever. The skin is sensitive, but the general consciousness is dull, and there is manifested an unnatural lax carriage of the body.

The disease is compared with cerebro-spinal meningitis. It differs, however, from this latter disease in that the membranes surrounding the brain and spinal cord are not strictly inflamed as in meningitis. In the Borna horse disease the veins of the membranes surrounding the central nerve system are congested. During the latter stages of the disease there is an elevation in temperature, a more frequent pulse, and an acceleration of the rate of breathing. There are also manifested various nervous irregularities, chills, involuntary twitching of various muscles about the head and other parts of the body. The muscles of the larynx are frequently paralyzed so that swallowing is impossible. The disease lasts from 10 to 18 days. The paralysis gradually extends over the whole body and death results. A recovery seldom occurs. From 70 to 80 per cent of the horses attacked with this disease in Borna died.

As preventive measures, the author recommends the immediate isolation of horses which begin to manifest the symptoms of the disease, and a thorough disinfection of the stalls.

Materials for the study of hemorrhagic septicæmia (swine plague), K. Z. KLEPTSOV (*Uchen. Zapiski Kazan Vet. Inst., 16 (1899), No. 4, pp. 247–334*).—In different parts of Russia there are yearly outbreaks of infectious swine diseases in the form of an enzooty or an epizooty. In 1896 the ravages from these diseases were especially large. The greater part of the author's observations were made in the Moscow stock yards and slaughterhouses. The author devotes 25 pages of the paper to a discussion of the literature of the subject, and a bibliography is given in this connection. His experimental investigations are reported under the following headings: (1) Pneumonic forms, including catarrhal or broncho pneumonia, croupous pneumonia, and caseous pneumonia; (2) pleuritis; (3) caseous replacement processes in the lymphatic glands; (4) pseudotuberculous forms; and (5) intestinal forms. In acute cases the temperature varied from 40.8 to 41.2°, pulse from 110 to 150, respiration from 60 to 90. Numerous cultures of the pathogenic organism were made and control experiments were carried out by inoculation of rabbits and guinea pigs. In a concluding section of the article the author gives a detailed account of his studies on the morphology and biology of the Schütz-Löffler bacillus.

Researches on spirillum disease of geese, J. CANTACUZÈNE (*Ann. Inst. Pasteur, 13 (1899), No. 7, pp. 529–557, pls. 2*).—The two diseases which are known to be caused by the rapid multiplication in the blood of micro-organisms belonging to the genus spirillum are intermittent fever of man and a form of septicæmia of geese. The present paper is an account of experiments undertaken to determine the question of the manner and means of disappearance of the spirillum at the crisis of the disease. The two views which are commonly held concerning the disappearance are that the spirillum is destroyed by a bacteriacide substance in the blood and that the spirillum is surrounded by the phagocyte cells. The technical methods which the author adopted may be stated as follows: Small bits of the organs to be studied were fixed in dilute Flemming's fluid, the tissue is left 24 hours in the fixing reagent. It is then washed in water for 24 hours; embedded in paraffin; sectioned, and colored on the slide in a stain made as follows: Fuchsin solution of Ziehl, 2 parts; neutral glycerin, 1 part. The fuchsin solution of Ziehl may be replaced by Magenta. The sections are mounted in Canada balsam. The author maintains that imperfection of method has led to results which indicated the destruction of the spirillum in the blood by means of an antitoxic serum. The author also obtained similar appearances by overheating the tissue, but believes that the granulations to be seen under such circumstances and which are supposed to be disintegrated remains of spirillum are really artificial products.

The author experimented upon geese and young chickens. Adult gallinaceous fowl are not susceptible to the disease, but young chickens are seldom able to withstand the disease when produced by inoculation. The author concludes that the conditions of the medium in which the spirillum lives, when observed in glass vessels, are so different from those under which the spirillum is found in living animals that no conclusions can be drawn from observations made under the former conditions and be applied to the action of spirillum upon living organisms. The author further maintains that the sudden disappearance of the spirillum in the drawn blood of diseased geese is due to products which arise in the blood after being drawn from the body and that this phenomenon is never witnessed in the living organism. The author was able to observe the immobilization, agglomeration, and disintegration of spirillum in drawn blood when under observation in glass vessels, but maintains that these processes are very seldom seen in living organisms.

The author's conclusions as to the agent which is most active in destroying the spirillum may be stated as follows: Spirillum is not destroyed in the blood. It is found immediately after the crisis of the disease almost exclusively in the spleen and red marrow of bone. The glandular cells of the spleen are very active in destroying the spirillum from the beginning of the disease. The activity of these cells increases rapidly until the crisis in temperature, which frequently occurs after the actual destruction of the spirillum.

Report of the board of cattle commissioners (*Massachusetts State Bd. Agr. Rpt. 1898, pp. 485–550*).—This report contains an account of the general operations of the board for the year, including statistical tables of the indemnities for animals killed for tuberculosis, the expenses of inspectors in various parts of the State, an account of the percentages of tuberculous animals in Massachusetts, and a discussion of the advisability of keeping up quarantine on the cattle from outside of the State.

During the year 385 horses have been killed as being glanderous. The tests used were the mallein and guinea pig tests, the latter being preferred.

In regard to rabies the board recommends more drastic measures, such as destroying all suspected dogs, and a more careful enforcement of the license law for dogs, which will have a tendency to reduce the great number of stray dogs. The board recommends the establishment of a Pasteur Institute in Boston.

An appendix to the report gives outlines of the inspection laws for cattle in various foreign countries and the States of this country.

Stable disinfection, J. B. Paige (*Massachusetts State Bd. Agr. Rpt. 1898, pp. 369–377*).—Proper stable disinfection is necessary in order to prevent the spreading of infectious diseases. The author calls attention to the value, as a germicide, of direct sunlight. For disinfecting instruments about the stable, dry heat may be applied. Twenty minutes' exposure at a temperature of 300° F. will destroy any pathogenic organism. For materials that can not be exposed to dry heat, moist heat may be applied in the form of boiling water or steam. As a disinfectant upon woodwork and other materials about the stable, the author recommends carbolic acid in a 5 per cent aqueous solution. This may be used for the disinfection of walls, floors, mangers, and harness.

Among other disinfectants are mentioned creolin, lysol, disinfektol, corrosive sublimate, sulphur dioxid, and chlorin. Both sulphur dioxid and chlorin are more effective in moist than dry atmosphere.

A summary of the most important Italian works in the field of general pathology and pathological anatomy during the year 1898, O. Barbacci (*Centbl. Allg. Path. u. Path. Anat., 10 (1899), No. 13–14, pp. 504–558*).

Outlines of animal diseases and parasitic infections for farmers and students, H. Kästenbaum (*Grundriss der Thierseuchen und der Parasitenkrankheiten für Landwirte und Studierende. Vienna and Leipsic: W. Braumüller, 1899, pp. 281, figs. 39*).—This work contains a general account of the conditions of health, inflammation, fever, the general purposes of therapeutics, and vaccination. The greater part of the book is occupied with a discussion of special diseases. The more important infectious diseases of domesticated animals are treated with reference to their etiology, symptoms, pathology, prognosis, therapeutics, prophylaxis, and serum inoculations. The author also discusses the more important diseases of domestic animals which are caused by parasitic round and flat worms, and various species of mites.

To what extent ought expenses and losses caused by contagious diseases of farm animals be compensated by the State, J. Lundgren (*K. Landt. Akad. Handl., 33 (1899), No. 2, pp. 107–121*).

The regulation of compulsory quarantine for animals imported from foreign countries, A. Vrijburg (*Veeartsenijk. Bladen v. Nederl.-Indië, 12 (1899), No. 1, pp. 31–34*).—A statement and justification of the law.

An arrangement for municipal ownership of slaughterhouses, L. Pearson (*Jour. Comp. Med. and Vet. Arch., 20 (1899), No. 4, pp. 199–204*).—A plan is suggested for city ownership of slaughterhouses with official inspection of animals and meat. It is believed that the price of meat will not be increased and that the quality will be better.

Sanitary regulations for animals, E. PERRONCITO (*Giorn. R. Accad. Vet.*, *48* (*1899*), *No. 16*, *pp. 361–365*).—Advises the use of all immunizing sera and toxin tests for determining the presence of infectious diseases with a view to their final extermination.

Some remarks on the hygiene of cattle, C. VAN DAMME (*Rev. Gén. Agron.* [*Louvain*], *8* (*1899*), *No. 8–9*, *pp. 377–385*).—A general discussion of the construction of stables; the airing, lighting, and heating of the same; and the feeding, pasturing, and reproduction of cattle.

The science of feeding green fodder, A. REUL (*Ann. Med. Vet.*, *48* (*1899*), *No. 6*, *pp. 304–318*).—Contains a series of recommendations with regard to the time of turning animals upon green pasture and with regard to the hygienic value and action of green grass.

The application of Roentgen rays in veterinary practice, M. A. MALTZEV (*Arch. Vet. Nauk*, *St. Petersburg*, *29* (*1899*), *No. 6*, *pp. 291–298*).—This paper contains a description of the apparatus necessary for the application of X-rays to the study of veterinary science, with a suggestion of cases in which it would be of service.

Urinary calculi of domesticated animals, M. KLIMMER (*Arch. Wiss. u. Prakt. Thierh.*, *25* (*1899*), *No. 5*, *pp. 336–366*).—A general discussion of the chemical constitution of calculi, of theories concerning the method of their formation, and of the etiology, with a bibliography of 126 titles.

A preliminary note on the morphology and distribution of the organism found in the Tsetse fly disease, H. G. PLIMMER and J. R. BRADFORD (*Proc. Roy. Soc.* [*London*], *65* (*1899*), *No. 418*, *pp. 274–281*).—This paper contains a description of the adult form of Trypanosoma, its distribution in the body of normal animals, in the blood, lymphatic glands, spleen, and bone marrow. A brief discussion is given of the methods of reproduction and the various forms under which the organism appears during its life history, including amœboid, plasmodial, and flagellate forms.

Cotton-seed disease, F. C. MCCURDY (*Jour. Comp. Med. and Vet. Arch.*, *20* (*1899*), *No. 9*, *pp. 560–567*).—Describes the general symptoms of poisoning by overfeeding with this substance, and the lesions in the eyes of animals so poisoned.

Cornstalk diseases, A. BOSTROM (*Jour. Comp. Med. and Vet. Arch.*, *20* (*1899*), *No. 6*, *pp. 336–339*).—Cornstalks when infested with fungi may cause acute tympanitis, indigestion, gastritis, and fungus poisoning.

Tympanitis in cattle, S. BIELER (*Chron. Agr. Canton Vaud*, *12* (*1899*), *No. 17*, *pp. 379–383*).—Wild mustard when eaten by cattle is said to check the action of the stomach and thus favor fermentation. Volatile alkalies are recommended for mild tympanitis and ruminotomy for advanced cases.

The possibility of tuberculous infection of the lymph system through milk and milk products, H. JAEGER (*Hyg. Rundschau*, *9* (*1899*), *No. 16*, *pp. 801–817*).—The author believes on the basis of a large number of observations that the great majority of the cases of tuberculosis come about from infection through the alimentary tract. Experiments showed that many young animals in which no physical signs of tuberculosis could be recognized responded to tuberculin, and a *post-mortem* examination always revealed the presence of tubercle bacilli in glands of the lymph system. The author considers it an important matter to prevent the use of tuberculous milk either by human beings or as food for domesticated animals.

Stamping out tuberculosis (*Breeders' Gaz.*, *35* (*1899*), *No. 24*, *p. 712*).—Contains Nocard's regulations for exterminating tuberculosis from an infected herd.

Tuberculosis in cattle, D. MCEACHRAN (*Agr. Gaz.* [*Tasmania*], *6* (*1899*), *No. 11*, *pp. 217–219*).—Discusses the nature of the disease, indemnity, danger from milk infection, symptoms and diagnosis of tuberculosis, and tuberculin tests.

Further experimental investigations on the serotherapy of tuberculosis, MAFFUCCI and DI VESTEA (*Centbl. Bakt. u. Par.*, *1. Abt.*, *25* (*1899*), *No. 23*, *pp. 809–815*).—The authors experimented upon calves and dogs with the purpose of producing, if possible, antitoxic effects upon the tubercle bacillus, as has been done with some other diseases. The results were encouraging.

The real value of the tuberculin test, M. Kühnan (*Berlin. Tierärztl. Wchnschr., (1899), No. 23, pp. 275–278*).—This article gives a record of a large number of cases where the tuberculin test was used, with a discussion of the results.

The differences between the bacillus of chicken tuberculosis and that of man which are shown in growth upon vegetable, gelatin, and agar-agar culture media, T. Matzuschita (*Centbl. Bakt. u. Par., 1. Abt., 26 (1899), No. 4–5, pp. 125–135*).—This article contains a technical description of the different appearances of these bacilli upon various culture media.

Cattle plague in Turkey, Réfik-Bey (*Ann. Inst. Pasteur, 13 (1899), No. 7, pp. 596–608*).—This article contains a discussion of the more important epidemics of the cattle plague in Turkey; of the clinical forms which the disease assumes and the rate of mortality. Aphthous fever and bovine malaria are discussed as being frequently associated with cattle plague. The author gives an account of the government regulations for the use of serum treatment and the success attending its treatment.

On immunization against cattle plague (*Selsk. Khoz. i Lyesov., 192 (1899), Feb., pp. 421–422*).—A brief description of the method of producing a mild form of the disease with virus and of thus conferring immunity.

The results of vaccination for protection against blackleg in Canton Freiburg, M. Strebel (*Giorn. R. Accad. Vet. Ital., 48 (1899), No. 21, pp. 110–121*).—Gives a description of the methods of vaccination. The animals were vaccinated near the end of the tail. Tables are given showing the percentages of cases in vaccinated and unvaccinated animals. The results were favorable for vaccination.

Contribution to the study of blackleg, L. Schöberl (*Berlin. Tierärztl. Wchnschr., 1889, No. 28, pp. 336, 337*).—Calls attention to difficulties in the way of studying blackleg and outlines the unsolved problems in connection with its study.

Contributions to serum therapy, W. Kolle (*Berlin. Klin. Wchnschr., 36 (1899), No. 24, pp. 520–521*).—Discusses the limitations of antitoxin treatments and gives a statistical table showing the effect of serum in treatment of Rinderpest. The results were favorable. The doses varried from 20 to 50 cc.

Regulations for the control of contagious diseases of live stock, C. Curtice (*North Carolina State Bd. Agr. Bul., 20 (1899), No. 7, pp. 9–11*).—A statement of regulations adopted by the State Board of Agriculture against Texas cattle fever.

Preventive inoculation against red water, D. Hutcheon (*Agr. Jour. Cape Good Hope, 14 (1899), No. 11, pp. 722–725*).—General directions for producing immunity in herds.

Treatment of milk fever with iodid of potash, E. Turkin (*Arch. Vet. Nauk, St. Petersburg, 29 (1899) No. 6, pp. 331–334*).

A new treatment of milk fever, A. S. Alexander (*Breeders' Gaz., 35 (1899), No. 5, p. 116*).—The author recommends the potassium iodid treatment of Schmidt and gives details of the technique of its use.

Serotherapy of aphthous fever, H. Mastbaum (*Arch. Rural, Portugal, 4 (1899), No. 5, pp. 71–73*).—Gives directions for the preparation of the antitoxin and method of application.

Diseases of the udder and teats, W. H. Austin (*Jour. Comp. Med. and Vet. Arch., 20 (1899), No. 8, pp. 488–490*).—Since many cases of mammitis are tubercular, the use of the tuberculin test is recommended in all suspicious cases of udder disease.

The scab in sheep, H. Stewart (*Country Gent., 64 (1899), No. 2421, p. 492*).—Discusses the nature and cause of the disease and methods of preventing or curing it by various dips.

Ticks and "louping-ill," E. G. Wheeler (*Sci. Gossip, 6 (1899), No. 64, pp 106–110, figs. 7*).—The conclusion of the author's paper on this subject with notes on *Ixodes plumbeus*, *I. hexagonus*, and *I. reduvius*).

Geel-dikkop investigations, Dixon (*Agr. Jour. Cape Good Hope, 14 (1899), No.*

12, pp. 782–784).—A disease of sheep and goats characterized by swelling of the head and yellow exudations. Gives symptoms, *post-mortem* appearances, and reports that large doses of calomel gave good results.

Experimental swine plague, M. PRETTNER (*Centbl. Bakt. u. Par., 1. Abt., 25 (1899), Nos. 21, 22, pp. 744, 745*).—The hog is shown to be exceedingly susceptible to subcutaneous inoculations of swine plague.

Treatment for swine diseases, I, D. E. SALMON (*Breeders' Gaz., 35 (1899), No. 4, pp. 88, 89*).—Gives statistics of losses from swine diseases and recommendation of the serum treatment.

The practical application of the Pasteur prophylactic inoculations against hog cholera, O. I. MARKEVICH (*Arch. Vet. Nauk, St. Petersburg, 29 (1899), No. 6, pp. 321–331*).

Combating hog cholera, FOTH (*Berlin. Tierärztl. Wchnschr., 1899, No. 29, pp. 347–351*).—The paper discusses the effect of serum upon diseased swine and experiments to determine the duration of immunity produced by serum treatment.

Serum as a remedy for hog cholera, J. D. SPRAGUE (*Jour. Comp. Med. and. Vet. Arch., 20 (1899), No. 6, pp. 342–346*).—Records the results of tests on 7 herds of hogs, and gives recommendations as to time for giving the serum and the amount to give.

Inoculation in utero, D. B. SAYRE (*Breeders' Gaz., 35 (1899), No. 5, pp. 117, 118*).—Reports successful experiments in inoculating sows with a mild form of hog cholera so as to produce complete immunity in their offspring.

The diagnostic value of mallein injections, N. A. SHADRINE (*K voprosu o diagnosticheskikh inektziyakh malleina. Moscow, 1898, pp. 161; rev. in Selsk. Khoz. i Lyesov, 192 (1899), March, pp. 705, 706*).—During the years 1893–1896, 226 horses which were suspected of having glanders were tested with mallein. From these experiments the author obtained results which led him to the conclusion that while mallein is not absolutely infallible as a diagnostic agent for glanders, it can be thoroughly relied upon in the hands of a veterinary practitioner.—P. FIREMAN.

Experiments with a serum treatment of contagious pleuro-pneumonia of horses, E. N. USOLTZEV (*Arch. Vet. Nauk, St. Petersburg, 29 (1899), No. 1, pp. 49–62*).—Experimental work has been carried on with some success, and other experiments are to be made to determine the duration of immunity and the best method of preparing the serum so that it can be kept ready for use during a considerable time.

A dangerous poultry pest, E. S. ZÜRN (*Fühling's Landw. Ztg., 48 (1899), No. 16, pp. 625–627*).—An account of chicken tuberculosis, with suggestions of means for controlling it.

Nematode worm disease of fowls (*Geflügel Züchter, 4 (1899), No. 38, p. 344*).—Biological notes on species of Filaria, with a brief statement of symptoms of disease caused by these worms.

Serum therapy in roup of chickens, D. V. DEVEL (*Arch. Vet. Nauk, St. Petersburg, 29 (1899), No. 1, pp. 30–49*).—A report of experiments in which temporary immunity was produced by inoculations.

The trichina inspector, H. A. JOHNE (*Der Trichinenschauer. Berlin: P. Parey, 1898, pp. XIV+170, figs. 125*).—This book gives a general account of the anatomy of the animal body microscopic technique, cestode, trematode, and nematode worms and their identification in meat. A statement is added of the regulations regarding meat inspection in different parts of the German Empire.

On the influence of common salt upon bacteria which are concerned in cases of meat poisoning, E. STADLER (*Arch. Hyg., 35 (1899), No. 1, pp. 40–82*).—Contains a record of experiments in subjecting various bacteria to solutions of common salt with the purpose of determining whether pickled meats may be considered sterilized. The results show that *Bacterium coli communis* subjected to 7 to 8 per cent solution of common salt was still alive after 6 weeks. *Bacillus morbificans bovis* in a solution of 8 to 10 per cent of common salt was dead after 3 weeks. *B. enteritidis*, in a solution of 7 to 8 per cent of common salt, died after 4½ weeks. *Bacillus proteus vulgaris* in an 8 to 10 per cent common salt solution did not die after a 3 weeks' exposure.

AGRICULTURAL ENGINEERING.

Description of the new dairy and stock-judging building, W. L. CARLYLE (*Wisconsin Sta. Rpt. 1898, pp. 269-282, figs. 15*).—The building is a frame structure, consisting of the barn proper, 50 by 86 ft., 3 stories high; and 2 wings, one 50 by 70 ft., the other 30 by 70 ft., and each 2 stories high (fig. 3). A class room for stock judging, 40 by 70 ft., well lighted and heated and provided with a tan-bark floor and seats along one side, is located between the wings. At one corner is a circular silo of brick, terminating in a water tower. A steel trestle furnishes a driveway with a moderate grade (7 ft. to 100) to the third story of the main building. All material for filling the silo and for feeding and bedding the stock is taken to the third floor, weighed, if desired, on the scales at the entrance, and then passed with little work to the stables below. The silage and feed cutters and mills for grinding are on this floor.

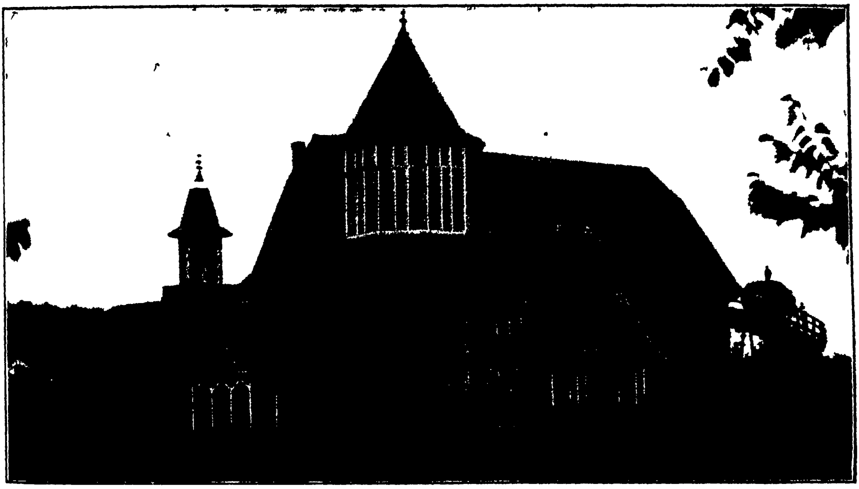

FIG 3.—Dairy barn and stock judging building, College of Agriculture, University of Wisconsin.

"The motive power for machinery is a 10-horsepower electric motor placed on a small truck which runs on an iron track, so that it may be shifted at a moment's notice from one side of the barn to the other. The car is provided with clamps, which grip the rails, so that it can be held in place at any point desired."

The ground plan of the building is shown in the accompanying illustration (fig. 4).

The cow stable, which is 40 by 70 ft., is lined with corrugated galvanized-iron sheeting. The floors are of Portland cement and crushed granite (fig. 5).

"The manure gutters behind the cows (H) are 16 in. wide with the bottom sloping ½ in. to the rear side and 1½ in. of slope towards the center of the stable, where a trap can be opened, connected with a sewer, to be used only in flushing out the stable with water. The floor of the cow stalls is raised 4 in. above the other parts of the stable floor, including the walk behind the cows (fig. 5), making the manure gutter 8 in. deep on the side to the cow and only 4 in. deep on the side to the passage behind. . . . The mangers are built up from and composed of the same material as the floor. . . . The side of the manger next to the cow is 8 in. high and 3 in. thick, rounding down into the bottom, as shown at (E). The front side of the manger is 16 in. high and built in a similar manner. This manger is 2 ft. 6 in. wide and reaches from one end of the stable to the other. It is used both as a feeding manger and as a watering device."

The stalls, 36 in number, 18 on either side of the stable, are constructed of gas-pipe posts anchored in the cement foundation, with framework of gates and panels of channel iron supporting a mesh of No. 7 woven steel wire. In fig 5, C indicates the framework extending in front of each row of stalls to support the front part of the side panels and give them rigidity; and D indicates the swinging panel which may be moved to suit the length of the cow. The side panels of the stalls are hinged to accommodate the milkers and allow the cows to pass out without backing over the manure gutter.

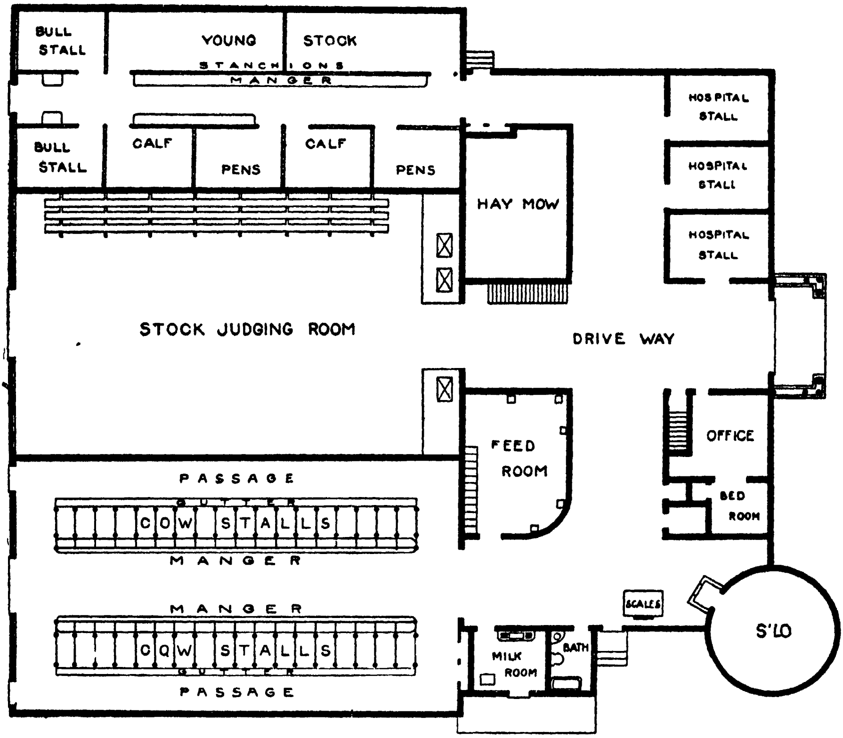

FIG 4.—First floor of barn, showing stables, stock judging room, etc.

The right wing of the barn, 70 by 30 ft., is designed for young stock and bulls. The lining of the walls and the construction of the floors is the same as in the cow stables.

"The partitions of the stalls are gas pipe imbedded in the cement floor at one end. This stable also has mangers of cement except for the very young calves. . . . Every fourth bar in the partition separating the stalls from the passageway is a swinging bar or stanchion. . . . The bull stalls are similar to those for the young stock with the exception of there being but one heavy stanchion. The bars are heavier and stronger and the gate to the stall is made of iron gas pipe. . . .

"Under the main part of the barn is a basement divided into 2 rooms. One of these is for the storage of roots and other products, while in the other is located the heating plant, the farm workshop, and the artesian well with a power pump operated by a 3-H. P. electric motor. This pump forces water into a large steel tank above the silo from which a supply is drawn through under-ground pipes to all the farm buildings."

The silo, 18 ft. in diameter and 33 ft. deep, is a frame structure lined inside and out with brick, the inner lining being covered with a heavy coating of Portland cement, which makes the silo practically water-tight.

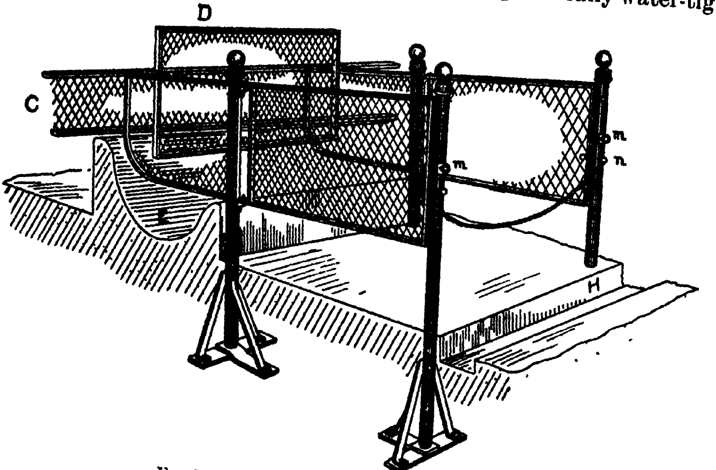

FIG. 5.—Perspective view of improved cow stall.

"The system of ventilation, originated by Prof. King for use in the stables, is shown in fig. 6 and is thus described by him: 'A single ventilating flue, D E, rises above the roof of the main barn, and is divided below the roof into 2 arms, A B D, which terminate at near the level of the stable floor at A A. These openings are provided with ordinary registers, with valves to be opened and closed when desired. Two other ventilators are placed at B B, to be used when the stable is too warm, but are provided with valves to be closed at other times. C is a direct 12-inch ventilator leading into the main shaft and opening from the ceiling, so as to admit a current of warm air at all times to the main shaft to help force the draft. This ventilating shaft is made of galvanized iron, the upper portion being 3 ft. in diameter. The covering on the outside is simply for architectural effect. The air enters the stable at various points as shown in the plan at F G, and in the vertical section by arrows at F. G.'"

State and national control of water, J. M. WILSON (*Irrig. Age, 14 (1899), No. 2, pp. 40–46*).—A paper by the State engineer of Nebraska presented at the eighth annual Irrigation Congress.

Reservoir irrigation on the plains (*Drainage Jour., 21 (1899), No. 8, p. 206*).

Water development, T. S. VAN DYKE (*Irrig. Age, 14 (1899), No. 2, pp. 47–53*).—Discusses especially the storage of water in California.

Douglas irrigation works on Vaal River, Griqualand West, W. CRAIG (*Cape Town: W. A. Richards & Co., 1899, pp. 13, pls. 15, figs. 4, map 1*).—This is a report to Parliament, and includes a "description of the schemes and information regarding the whole works as completed to December, 1898, with plan and photographs." About 887 acres are under irrigation.

Petroleum motors, J. GOBIET (*L'Ing. Agr. Gembloux, 9 (1899), No. 12, pp. 713-742*).

Disputed points in connection with the construction and maintenance of macadamized roads, H. IRWIN (*Trans. Canad. Soc. Civ. Eng., 12 (1898), pt. 2, pp. 148-176*).—The principal points discussed are grades, drainage, transverse section, the necessity for using the Telford foundation, and its construction, the construction of macadamized roads without the Telford foundation, quality of stone and size of the macadam, binding material and its usefulness, rolling by horse or steam roller, and repairs or maintenance.

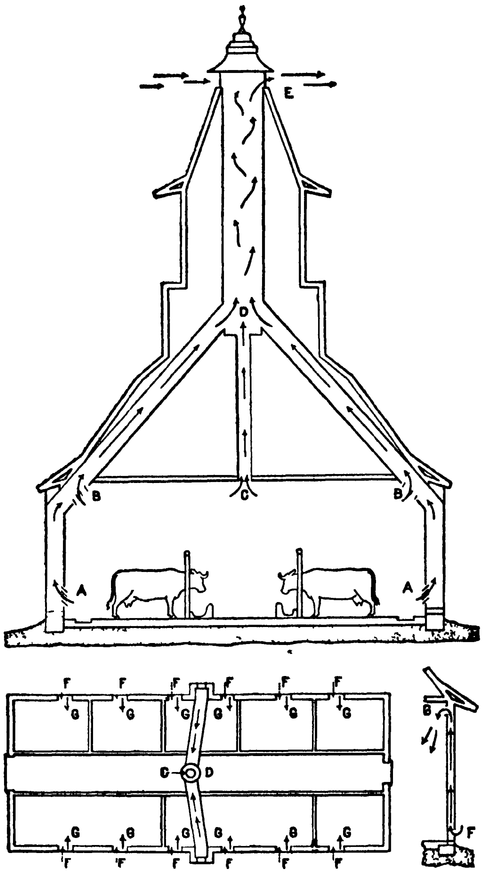

FIG 6.—System of ventilation

Natural and artificial methods of ventilation (*London: Robert Boyle & Son, Ltd., 1899, pp. XVI+66*).

Application of electricity in agriculture (*Deut. Landw. Presse, 26 (1899), No. 84, pp. 953, 954, figs. 15*).—Applications of electricity as motive power for feed cutters, mills, threshers, and dairy apparatus, and for heating ovens, kettles, irons, etc., are discussed.

STATISTICS—MISCELLANEOUS.

Eleventh Annual Report of Massachusetts Hatch Station, 1898 (*Massachusetts Hatch Sta. Rpt. 1898, pp. 172*).—This embraces a brief summary of the work of the year, including the organization list of the station and a list of available bulletins; a financial statement for the fiscal year ended June 30, 1898; and reports of the meteorologist, horticulturist, chemists, agriculturist, entomologist, and botanist, parts of which are noted elsewhere in this issue.

Eighth and Ninth Annual Reports of New Mexico Station, 1897 and 1898 (*New Mexico Sta. Rpts. 1897 and 1898, pp. 3-31*).—The staffs, publications, lines of work, and expenditures of the station for each year are given in the reports of the director, treasurer, and heads of departments.

Fifteenth Annual Report of Wisconsin Station, 1898 (*Wisconsin Sta. Rpt. 1898, pp. 312, figs. 70*).—This includes the organization list of the station; a report by the director on the staff, work, equipment, and publications of the station; numerous articles noted elsewhere; lists of exchanges and acknowledgments; a financial statement for the fiscal year ended June 30, 1898; and reprints, in an abridged form, of Bulletins 64, 68, and 69 of the station, embracing the following subjects: Sugar-beet culture in Wisconsin during 1897 (E. S. R., 10, p. 39); one year's work done by a 16-foot geared windmill (E. S. R., 10, p. 695); pasteurization experiments in butter making, score of butter as affected by size of package, and propagation of starter for ripening cream (E. S. R., 10, p. 889), and an improved curd test for the detection of tainted milk (E. S. R., 10, p. 386).

Experiment Station Work—XI (*U. S. Dept. Agr., Farmers' Bul. 108, pp. 32, figs. 5*).—This number contains popular articles on the following subjects: Excessive irrigation, cross-pollination of plums, root pruning of fruit trees, the oxeye daisy, poisoning by wild cherry leaves, preserving eggs, gestation in cows, the long clam, silage for horses and hogs, commercial butter cultures with pasteurized cream, and the stave silo.

Experiment Station Work—XII (*U. S. Dept. Agr., Farmers' Bul. 105, pp. 32, figs. 4*).—The following subjects are treated in this number: Seaweed, the tillering of grains, fertilizers for garden crops, sweet corn and pole beans under glass, girdling grapevines, cereal breakfast foods, food value of stone fruits, when to cut alfalfa, spontaneous combustion of hay, preservation of milk by pressure, and cream raising by dilution.

The mission of the agricultural colleges, W. H. JORDAN (*Massachusetts State Bd. Agr. Rpt. 1898, pp, 51-72*).

Agricultural education in foreign countries, W. E. DE RIEMER (*Pop. Sci. Mo., 56 (1899), No. 2, pp. 218-233*).

Agricultural education in Ireland, A. STEEDMAN (*Farmers' Gaz., 58 (1899), Nos. 35, pp. 745, 746; 37, pp. 772, 773, 791, 792; 38, p. 813; 39, p. 835; 40, pp. 857, 858; 41, pp. 877, 878; 42, pp. 907, 908; 43, pp. 929, 930; 44, pp. 949, 950; 45, p. 969; 46, p. 990*).—Series of articles on this subject.

Agricultural education in France (*Jour. Bd. Agr. [London], 6 (1899), No. 2, pp. 199-205*).—A general summary of the agricultural educational system of France.

The organization of a division of information in metereology and agriculture in the Department of Hérault, HOUDAILLE (*Organisation d'un service d'information météorologiques et agricoles dans le département de l'Hérault. Montpellier: Grollier, 1899, pp. 38*).

Practical lessons in agriculture, GAUDELETTE (*Leçons pratiques et lectures agricoles. Paris: Giard, 1899, pp. 196*).

NOTES.

ARKANSAS UNIVERSITY AND STATION.—J. T. Stinson, horticulturist, has resigned to accept the directorship of the new Missouri Fruit Experiment Station. Ernest Walker, of the South Carolina College and Station, has been appointed horticulturist and entomologist in the university and station.

COLORADO COLLEGE AND STATION.—The college intends to procure an illustrative herd of the best breeds of cattle. The farm committee of the State board of agriculture, consisting of Messrs. Harris, Chatfield, and Amiss, have been authorized to expend $4,000 for this purpose and to visit some of the best herds in the States east of Colorado to make the selection. A course in veterinary science has been arranged for, with George Glover, D. V. M., of Denver, in charge. Lectures and clinics will be given weekly. The State board of agriculture at its December meeting adopted rules and regulations for the experiment station, placing additional power and responsibility in the hands of the director. Provision was made for closing out the substations at Montevista and Monument, which have been suspended for several years past, and for reducing the area under cultivation at Rockyford and Cheyenne Wells, so as to enable the superintendents to act more as field agents and to be available in investigations which it is desirable to carry out in the localities. The name of the station at Cheyenne Wells is changed from Rainbelt to the Plains Substation.

CONNECTICUT STATE STATION.—At the recent annual meeting of the board of control Prof. S. W. Johnson resigned his position as director, desiring to be relieved of the executive duties which he has been charged with for nearly 23 years. In accepting his resignation the board adopted resolutions expressing its deep appreciation of the distinguished services of Professor Johnson and their regret that he felt moved to relinquish his more responsible duties. Professor Johnson has consented to retain connection with the station in the capacity of consulting or advisory chemist. E. H. Jenkins, who has been the vice-director for the past 17 years, succeeds him as director.

MISSISSIPPI STATION.—The station office building was burned December 24, 1899; the loss is nearly all covered by insurance.

NORTH CAROLINA STATION.—H. W. Primrose, instructor in chemistry and assistant chemist of the station, has resigned to accept the position as assistant chemist with a private firm at Ensley, Ala. He has been succeeded in his station work by J. A. Bizzell, formerly assistant chemist, and in his college work by W. A. Syme class of 1899. The former station farm has been assigned to the horticultural department. Large plantations of fruits have been made for the purpose of studying climatic difficulties with some, and the treatment of diseases and insects with all. The new lines of work in horticulture will be a special study of plant breeding and the improvement of varieties. The experiments in the culture of flowering bulbs for florists' use are being continued. These experiments are attracting wide interest among horticulturists. A study of edible and poisonous mushrooms is to be undertaken, and notes from mycologists in other stations will be welcome.

NORTH DAKOTA STATION.—W. C. Langdon, veterinarian, has resigned and Dr. J. W. Dunham has been elected in his stead. F. V. Warren, instructor in steam engineering and assistant in mathematics, resigned during the fall term to accept a position in Philadelphia, and P. S. Rose, formerly of Michigan Agricultural College, was elected to fill the vacancy.

EXPERIMENT STATION RECORD.

VOL. XI. NO. 7.

The cooperative experiment station exhibit which has been prepared for the Paris exposition is now practically completed and is on its way to Paris. The first steps toward representing the experiment stations at the Paris exposition were taken by the Association of American Agricultural Colleges and Experiment Stations at Minneapolis in 1897, by the adoption of a resolution favoring an exhibit and the appointment of a committee of five to take charge of the matter. This committee consisted of H. P. Armsby, chairman, W. H. Jordan, A. W. Harris, M. A. Scovell, and A. C. True. The stations were invited to contribute materials and charts illustrating special features of their work and results, original pieces of apparatus, models, designs, etc. By a division of labor early agreed upon, the Director of this Office, as a member of the committee, undertook to make a collection of photographs and of publications of the stations, to prepare a monograph on the experiment station enterprise of this country, and to look after the temporary installation of the exhibit in Washington and its final shipment.

The space allotted for the exhibit in the Palace of Agriculture is 16 by 45 ft., a total of 720 sq. ft., with a wall space nearly 40 ft. in length. The material as it was prepared was shipped to Washington, where provision was made for installing it with a view to determining the best arrangement and the best utilization of the space. This matter has been in charge of W. H. Evans, of this Office, who has also supervised the preparation of a large number of charts and the photograph exhibit. The latter includes about 750 selected photographs of station buildings, grounds, laboratories, apparatus, experimental plats, herds, and other features, in addition to a collection of photographs of the station directors and staff members. This photographic exhibit makes an excellent showing, and is much the finest collection of experiment station pictures ever brought together, illustrating nearly every phase of the station work and equipment. In nearly all cases, the negatives were sent to Washington, so that all the photographs might be printed and finished alike. This has resulted in a much more pleasing and artistic effect. The pictures are mounted in groups on sheets of heavy cardboard 22 by 28 in., each sheet and each individual picture being labeled by hand. They will be displayed in portfolios of 24 sheets each.

This collection of photographs alone would suffice to furnish a good conception of the American stations, but the object exhibit has not been neglected, for this appeals to the eye of the more casual observer. A series of root cages furnished by the North Dakota Station shows the formation of the roots of maize, wheat, flax, and brome grass; a number of excellent models of sweet potatoes, peppers, apples, and plums, exhibited by the Iowa and Minnesota stations, illustrate varietal differences; and an exhibit of saltbush from the California Station shows such species of Atriplex as have proved of value on strongly alkaline soils. The soil work is represented by an exhibit from the Division of Soils of this Department, consisting of electrical devices for determining the salt content, temperature, and moisture content of soils, and a series of samples illustrating the typical agricultural soils of the United States; 6 typical California soils, sent by the station in that State, with specimens showing the result of mechanical analyses of each type of soil, and Hilgard's soil elutriator for mechanical analysis.

A number of pieces of original apparatus for investigations in vegetable physiology are shown, including an auxanometer for experimental work on the rate of plant growth, and a simple apparatus for determining the rate of transpiration of plants, both designed by L. C. Corbett, of the West Virginia Station; and a centrifuge used to study the effect of gravity and centrifugal force upon germinating seeds, designed by J. C. Arthur, of the Indiana Station. An olive exhibit, furnished by the California Station, consists of a set of 50 samples of olive oils and more than 200 samples of olive pits used in the classification of varieties of olives; and a collection of mounted specimens of cotton from the Alabama Station shows 72 selected and cross-bred varieties. A collection of 100 weed seeds, by B. D. Halsted, and an insect cabinet, designed by C. W. Woodworth of the California Station, are the sole representatives in their respective classes.

Samples of a considerable number of animal and vegetable fats are exhibited by the Missouri Station, and a collection of chemically pure proteids separated from the seeds of various plants, by T. B. Osborne, of the Connecticut State Station, is of much interest on account of the rarity of these products. The latter station has also contributed a gas desiccator, designed by S. W. Johnson, for drying hydrogen gas used in moisture determination. Two forms of the silo are shown in model, the ordinary round silo and the stave silo. An apparatus for the rapid cooling of wines in their manufacture, designed by the California Station, is exhibited by that station; and a pressure apparatus for experiments with solutions under very high pressure, designed by B. H. Hite, is shown by the West Virginia Station. A detail model of the Atwater-Rosa respiration calorimeter and a full-sized bomb calorimeter will illustrate our progress in these lines. Ten models and 8 photographs show the effect of different kinds of rations on the production of lean and fat meat, as determined in experiments with cattle, sheep, and pigs at a number of stations.

The dairy exhibit surpasses in extent that in any other single line. It includes a series of cheese models, exhibited by the New York State Station, showing the effect of the fat content of the milk on the size of cheese produced, and a collection of 48 cultures of dairy bacteria, prepared by H. W. Conn, of the Connecticut Storrs Station. The original Babcock milk tester is shown, and two more modern forms of the apparatus for hand and power operation, together with a quite complete collection of the various forms of apparatus used in the Babcock test. The Scovell milk-sampling tube, Wisconsin curd test, Marshall rennet test, acid bottles, and other minor apparatus are also shown.

An interesting feature of the exhibit is the irrigation apparatus and models. These include a hydrophore, used to determine the amount of silt carried by water, a nilometer, used to measure the amount of water passing through streams, flumes, and ditches, a current meter, used in measuring the rate of flow, and a water register, all designed by Elwood Mead; specimens of sheet-steel irrigation pipe, used extensively in rough regions in place of ditches or flumes, and models of a Cippoletti weir, measuring flume, and a truss and flume over a canyon, exhibited by this Office. A small exhibit from the Hawaiian Experiment Station consists of samples of rocks, lavas, lava products, and soils, varieties of sugar cane, and samples of agricultural products such as coffee, rice, and sugar.

In addition to the above object exhibit there are a large number of charts and enlarged pictures showing in graphic form the results of experiment station work on a wide range of subjects, as diseases of plants, nematode worms, soil and alkali investigations, effect of fertilizers, crossing of fruits and vegetables, feeding experiments, digestion coefficients, cheese ripening, egg production, irrigation enterprises, etc. The charts, most of them colored, have been executed by an expert and are excellent. They will be largely shown in portfolios, and it is expected that an attendant will be present to exhibit and explain them.

A complete set of bound bulletins and reports of the experiment stations and of this Office is shown, which makes quite an imposing array of agricultural literature. This is supplemented by the card index of experiment station literature, containing 18,000 cards, and by a large collection of books published privately by experiment station workers. Press notices, posters, and miscellaneous publications of the stations are shown in portfolios.

A manual of the American experiment stations is in the hands of the printer and will be ready in time to be included as a part of the station exhibit. This volume gives the history, organization, equipment, and lines of work of the stations, their relations to various other agricultural institutions, and their place in the great movement for the improvement and advancement of agriculture. It is illustrated by upward of 300 photo-engravings.

It will be apparent that abundant material has been provided in the various forms to give a fairly adequate idea of the American stations, and to furnish food for much study for visitors especially interested.

ARTIFICIAL CHANGES OF PHYSICAL PROPERTIES OF SOILS.

EWALD WOLLNY, PH. D.,

Professor in the Technical High School at Munich.

In this paper, which is a continuation of previous articles[1] on the physical properties of soils and their importance in the growth of plants, the author considers more particularly what practical means may be employed to impart to cultivated soils the greatest possible productiveness. That the proper cultivation of the soil is of prime importance is shown by the fact that other factors important in plant growth, *e. g.*, the plant food supplied by manures, can exert their full power only when the mechanical condition of the soil is favorable. Uncultivated soils generally fail to produce maximum yields. The most favorable physical conditions exist in those soils which consist of a thorough mixture of the several principal ingredients. Thus, soils in which either finely divided (clayey) or coarsely divided (sandy) ingredients predominate are unfavorable to the production of crops without decided changes in their properties, while soils in which the ingredients are mixed in certain proportions (medium soils) are generally productive. It is well known, for instance, that a pure humus soil, mainly on account of its physical nature, is not favorable to plant growth, but may be rendered productive by admixture with a soil deficient in humus.

PROPERTIES OF SOILS AS INDICATING THE NATURE OF THE CULTIVATION REQUIRED.

It is evident that in studying the various ways of cultivating soil, not only cohesion and adhesion, but also friction of the soil with the tools and the weight of a unit-volume of the soil, must be considered. The force with which the particles of soil cling to each other (cohere) is of prime importance in connection with the cultivation of the soil, since the ease or difficulty with which tools, penetrate the soil, and hence the labor required to cultivate the soil, depends primarily upon it. This is borne out by the results of investigations already referred to in the Record.[2] The controlling influence of cohesion may be inferred from the fact that it is the main factor determining the differences between soils, although the other properties of soils should also be taken into account, since the resistance to be overcome in cultivation is always due in part to them. In general, it may be said that humus offers the least resistance to cultivation, clay the greatest, while sand stands between the two extremes.

---

[1] E. S. R., 4, pp. 528, 627; 6, pp. 761, 853, 948.

[2] E. S. R., 6, p. 769.

If it be asked what practical means should be used to reduce to a minimum the labor of working soils, we should recommend a suitable change in composition of the soil as the first step. Thus, for example, mixing clay with sand diminishes both cohesion and adhesion of the soil, and renders it more easy to cultivate. It is true that by this treatment both the weight and friction of clay are increased, but, as modifications of cohesion and adhesion are more far-reaching, the increase in weight and friction may be neglected.

The improvement of the tillable properties of soils may be most perfectly attained by an increase in the proportion of humus. The working of clayey soil is by this means rendered very much less laborious, because both cohesion and adhesion, and also the weight, are diminished in proportion to the amount of humus added. For sandy soils also an increase of humus is of advantage, as it reduces friction and decreases the weight. It thus appears that manuring with materials of organic origin (stable manure, vegetable matter, straw, and peat)[1] greatly increases the ease of cultivation, and at the same time influences most favorably the chemical properties of the soil in many different ways.[2] Nor should the fact be overlooked that increasing the humus content promotes the tendency of the soil to assume the "crumbly" structure, and by this means still further reduces the mechanical resistance to cultivation. Soils of crumbly structure are not only naturally more fertile, but are very much more easily worked than those having a separate grain structure. Whatever manipulations, therefore, promote the formation of the crumbly structure and tend to make such structure permanent are of great value in soil cultivation, inasmuch as they both heighten the fertility of the soil and lessen the labor required for its cultivation. This is especially true of compact, heavy soils. To obtain this crumbly structure and to preserve it, several fundamental principles must be observed. These may be summed up briefly as follows: (1) The soil must be plowed immediately after the crop has been gathered; (2) it must be plowed only when it contains a medium amount of water (about 40 per cent of that which the soil is capable of holding); (3) the furrows must be as narrow as possible, especially at the first plowing; (4) the land destined for tillage in spring should be exposed in roughly plowed condition to the action of frosts during the winter; and (5) the formation of aggregates in the soil should be promoted by means of proper fertilizers. For the latter purpose humus-forming manures (stable and vegetable manure) as well as calcium hydrate (freshly slaked lime) are especially valuable. Hurtful influences, on the other hand, are exerted by such fertilizers as contain carbonates of the alkalis and soluble phosphates, inasmuch as these when applied in considerable quantities cause the soil particles to pack closely together. The same is true of materials rich in chlorids and nitrates. These salts promote the formation of crumbly structure while they remain in the soil, but when they are washed out by the rain water, they leave the soil in a puddled condition. This happens more or less with all salts which are not fixed by the soil. This can be corrected only by a careful selection and application of measures calculated to increase and preserve the percentage of humus in the soil.

---

[1] Vrtljschr. Bayer. Landw. Rath., 1897, pp. 293, 445.

[2] E. Wollny, Die Zersetzung der organischen Stoffe und die Humusbildungen in Rücksicht auf die Bodencultur. Heidelberg, Carl Winter, 1897.

RELATIONS OF SOILS TO AIR.

From the standpoint of the agriculturist, the principal property of soils in their relation to air is permeability, for on it depends the supply of oxygen required both for normal decomposition of organic material and for the respiration of the roots. The smaller and more densely packed the soil particles, the more limited the supply of oxygen and the greater the necessity for attempting to regulate the permeability. This end is best attained by mixing a fine-grained soil with sand and by inducing a crumbly structure. If too great humidity of the soil is responsible for the lack of permeability, only thorough drainage can correct the defect. If the soil has been deprived of its permeability by washing during periods of extraordinarily heavy precipitation, the best remedies are harrowing and hoeing between the rows, and heaping up the soil around the plants. The latter is a most efficient means of increasing permeability of the soil.

RELATIONS OF SOILS TO WATER.

Excess of water, either temporary or permanent, is hurtful to plant growth to a greater or less extent. Such a condition is a result principally of heavy precipitation on soils of high water capacity. The damage is most marked in case of basin-shaped fields on which water from neighboring fields accumulates, or which have an impervious subsoil at such a depth that the soil is kept in a state of saturation. The means adopted to correct this state of affairs will depend upon whether there is a permanent or only temporary excess of water. If the excess of water remains permanently or for a long period, it can be removed only by underdrainage or by the construction of ditches. The physical structure of the soil, more particularly its permeability and water capacity, determines the amount of water that may be removed by this means. The efficiency of the method consequently varies widely in different localities. A blind adherence to common rules of drainage may in some cases reduce the water supply in the soil to a degree dangerous to plant growth. This is the case (1) in all soils of small water capacity and considerable permeability (coarse-grained, sandy soils), (2) in soils offering considerable facilities for evaporation (peat and bog earth), and (3) in all soils occupied by plants requiring considerable amounts of moisture in the upper soil layer (meadows, perennial forage plants).

Thus, while the methods noted are effective in removing the hurtful excess of water, they may bring about a condition of dryness which in most cases, especially where rain is rare, and in time of drought, is unfavorable to the growth of maximum crops. To do away with this difficulty, which militates against the best interests of rational tillage of land, such means of regulation ought to be adopted as will either cause the water to drain off more slowly, or allow of complete stoppage of all flow temporarily. The former can be attained only imperfectly, because in the end all the water not held by the soil is removed; in the latter case, however, with proper care the moisture may be thoroughly utilized in accordance with the nature of the soil and the requirements of crops. Drainage can not be controlled effectively with open ditches, but it may very readily be done in case of under drains by calculating the diameter of the drain pipe on the basis of the quantity of water that percolates through hard, heavy soil. According to the experiments of the author, this amounts to 0.0008 cubic meter; or 0.8 liter per second and hectare.[1] With this as a basis, and starting with the smallest feasible diameter of pipe (4 cm.), the drainage system may be so constructed that part of the moisture may be kept in the soil for a long time. This, however, hardly answers the purpose, since the humidity of the soil, especially during the period of plant growth, can not be fully controlled. Hence it is recommended that open ditches be provided with board dams, and drains with flood gates, by means of which the flow of water may be interrupted either partly or entirely, as the occasion may require. This method is simple and easily applied in all ordinary forms of drainage.

The higher portions of a dangerously moist field should be reserved for grains and hoed crops, while the lower parts are used for crops which possess a high power of evaporation (such as meadows). Even in this case, however, the plants will suffer if the moisture in the soil exceeds 70 to 80 per cent of saturation.

The temporary pools which form on very fine-grained soils during heavy rains must be removed either by direct withdrawal of the water (water-furrows), or by such means as will bring about a diminution of the water capacity; in other words, an increase in permeability or an increase of evaporation from the soil. In the first case effort must be directed principally toward producing a crumbly structure through cultivation and manuring, as suggested above, since by this means the water-holding capacity of the soil is reduced and percolation promoted. On extremely fine-grained soils (clay soils, black earth), which in their unmodified condition offer the greatest resistance to the passage of water and become thoroughly moist only with the greatest difficulty, this process is indispensable in order that the precipitation may be of any use at all to plants.[2] A favorable modification of the water capacity and penetrability of such soils may also be brought about by admixture of soils of opposite physical characteristics, as, for instance, coarser grained soil (sand). By this means stiff soils are rendered more easy to cultivate, and are more readily changed into a condition of separate grain structure.

---

[1] Forsch. Agr. Phys. [Wollny], 19 (1896), p. 223 (E. S. R., 8, p. 676).

[2] Ibid., 18 (1895), p. 441.

Enlarging the surface of evaporation, as is done in ridge and hill culture, is another means of preventing harmful accumulation of water in soils. By this means, also, a portion of the rain water is removed from the reach of the plants by flowing into the furrows between the rows.

Close planting also assists to some extent in reducing the moisture in the soil by increasing the amount of water drawn from the soil by the crop.

It is a mistake to allow wet soils to lie fallow, especially in wet seasons, because the conditions in fallow soils are much less favorable to evaporation than in cultivated soils. Allowing soils to lie fallow, however, is not harmful; on the contrary, it may be useful, if the soil during a previous long drought has become dry to a considerable depth.

Lack of moisture in a soil may be corrected either by direct application of water (irrigation) or by increasing the absorptive power of the soil. Irrigation is to be recommended in all cases in which the water supplied by precipitation is insufficient for the production of maximum crops. The point at which irrigation becomes necessary varies in different localities and is determined by the energy of evaporation, the water-holding power of the soil, and the distribution of precipitation. In the warmer climates we may assume, as a rule, that when precipitation is less than 24 to 28 in. irrigation is required for maximum crops while in colder localities in which evaporation is less rapid and crops smaller, on account of the low temperature, the limit may be placed at about 16 in.[1]

With regard to the treatment of soils which have little water capacity, great permeability, and favorable conditions for evaporation, the aim should be mainly to keep the ground water at a proper level, or, if this is not possible, to increase the water capacity of the soil. The latter may be accomplished by admixture of fine-grained, earthy materials (clay, loam, and marl), or by increasing the percentage of humus through liberal applications of manures of organic origin (stable manure, peat, etc.).[2] Another, though less effective, means is rolling the soil, provided it be followed at the beginning of dry weather, by harrowing, hoeing, etc., to reduce evaporation.[3]

For soils of small water capacity such operations as limit evaporation as far as possible are generally recommended. Too frequent plowing of the soil should be avoided, and plowed land should be harrowed as soon as dry weather sets in, to reduce the surface of evaporation as much as possible. If the soil becomes too hard, as may happen as a result of violent rains or of rolling, loosening of the surface (harrowing, hoeing) is of great advantage in reducing evaporation and thus retaining moisture in the soil.[1] Furthermore, hill or ridge culture is to be avoided, since in this case evaporation is greater than in level culture. Close planting should not be practiced for the same reason. Allowing the soil to lie fallow may result in the storage of moisture in the soil, but it is recommended only when the soil is dry to a considerable depth. Finally, mulching or covering the soil with a layer of dead vegetable matter (stable manure, straw, etc.) reduces evaporation from the soil for a time at least.

---

[1] Forsch. Agr. Phys. [Wollny], 16 (1893), p. 131.

[2] Ibid., 18 (1895), p. 33.

[3] Ibid., 3 (1880), p. 325; 5 (1882), p. 2.

RELATION OF SOILS TO TEMPERATURE.

Keeping in mind the great influence directly and indirectly exerted by the temperature of the soil upon the growth of plants, the practical agriculturist will endeavor to find means to modify the temperature according to the necessities of the plants. In colder climates, naturally, efforts must be made to promote a rise in temperature, while in warmer regions it will often be necessary to proceed in the opposite direction. In what ways and to what extent the temperature of the soil may be influenced is briefly discussed below.

In the cultivation of plants which furnish products of high market value, such as vines, fruit trees, etc., and which require a rather high temperature, artificial changes in exposure or inclination (producing southwest, south, or southeast exposure, or inclining the plane of growth more directly toward the south) may be of considerable benefit, especially in cold climates. The method, however, will be productive of good results only when the soil contains sufficient moisture, because only in that case is the higher temperature beneficial and the increase in yield sufficient to justify the outlay required to make the change. This method need not be restricted to hilly lands but can be applied to level soils. Roof-like elevations may be constructed, with broad surfaces facing toward the south, and rather narrow exposures toward the north. The former may be planted to crops that require considerable warmth (vines, fruits, asparagus, etc.), and the latter may be reserved for grass or such other forage plants as require less heat. This method is not adapted to extensive field culture of crops furnishing products of comparatively low market value, both on account of the very unequal growth of the plants on the two opposite inclinations, and because the benefit derived even under favorable circumstances would not justify the outlay.

On hilly land in hot climates a reduction of the temperature of the soil may be necessary on steep inclinations facing toward the south, southeast, or southwest, because under such conditions, not taking into account the fact that the moisture is generally insufficient for maximum crops, the temperature of the soil frequently exceeds the limits for the perfect development of plants. In such cases the construction of terraces offers special advantages, since by their means the temperature of the soil may be lowered and the moisture in the soil regulated in accordance with the needs of the plants. Another common method of altering the exposure of the soil consists in the construction of beds, running through the whole length of the field, and separated from each other by furrows. The effect of this arrangement is to bring about a more rapid removal of water from surfaces of high water capacity, but, leaving out of account the fact that this result may be accomplished by simple means (water furrows), the process in question has the disadvantage of producing unequal heating of two oppositely inclined surfaces, resulting in unequal growth of the plants on the two sides. For this reason bed culture is not suited to fields that are to be planted with only one kind of crop. In such cases level cultivation, which secures a higher and more uniform temperature,[1] is decidedly preferable. If, however, this method is followed, the bed should run north and south if the field permits, since the difference in temperature between the east and west slopes is far less marked than that of slopes facing north and south. In other words, the disadvantage of unequal heating is least with beds running north and south.

---

[1] Forsch. Agr. Phys. [Wollny], 7 (1884), p. 52.

An excellent means of raising the temperature of the soil is the cultivation of plants in ridges or in hills. Soils so cultivated have a higher average temperature during the growing season than those cultivated level.[2] The effect is of longer duration in ridge culture than in hill culture, because in the former the ridges are constructed before seed time, while in the latter the hills are made only in the more advanced stages of growth of the plants. For this reason ridge culture is especially suited to plants which require a considerable amount of heat (maize, sunflower, beets, etc.) in climates unfavorable, as regards temperature, to the growth of these plants. However, this is true only for regions in which the weather in spring is not too cold, for the plants growing on the top of the ridges are, on account of their exposed position, more easily injured by late frosts in spring than those planted on the level soil and hilled up later. As a general rule, both these methods are mainly adapted to such soils as have little capacity for collecting and retaining heat (clayey and calcareous soils), and which are also apt to collect excessive quantities of water. It is evident that the increase of temperature due to ridge or hill culture is of no advantage on soils of little water capacity and great permeability (sand) when precipitation is scanty. Under such conditions level culture is to be preferred.[3] It should be remembered when ridge or hill culture is used that ridges running north and south are of higher and more uniform temperature than those running east and west.[4]

---

[1] Forsch. Agr. Phys. [Wollny], 1 (1878), p. 268; 10 (1887), p. 1.

[2] Ibid., 3 (1880), p. 118.

[3] Ibid., 20 (1897–98), p. 493.

[4] Ibid., 8 (1885), p. 19.

Regulation of the store of water in the soil is another means of modifying the temperature. If the soil is wet, elevation of temperature is brought about by removal of the excess of moisture. The proper means to this end are direct removal of water, lowering water capacity, and increasing permeability of the soil, as already explained. That the desired result may be obtained by these means has been proved by various experiments.[1] Another means of changing conditions of temperature in soils is intermixture with soils of opposite properties as regards heat. Admixture of sand with clay or earth rich in clay and limestone results, under normal conditions, in an average increase in the temperature of the soil, while the opposite process produces a lowering of the temperature of the soil. By thoroughly intermixing sand and humus soil a soil results which collects heat more rapidly and to a greater depth than is done by either separately. Increase of humus in mineral soils, as, for instance, by the liberal application of manures of organic origin, prevents extremes of temperature.[2]

We thus see that not only the structure of the soil but also its temperature may be affected by mechanical means. Change from separate grain structure to crumbly structure[3] generally improves, though to a small degree, the heat conditions of a soil, principally by reducing evaporation.[4] Rolling the soil is more effective because it increases the conductivity of the soil for heat and therefore, under normal conditions of weather, raises the temperature of the soil.[5] Loosening the surface of the soil by harrowing, hoeing, etc., results, on the contrary, in a decrease in the temperature of the soil.[6]

By covering the ground with dead matter (mulching) the temperature of the soil is increased or decreased according to the behavior of the covering toward heat. If, for example, a thin layer of black material (coal dust, black clay slate, etc.) is spread over the soil, the temperature of the soil rises to a considerable degree[7] and crops on soils so treated are accordingly benefited.[8] Although this process, for evident reasons, is not applicable to cultivation on a large scale, still with delicate plants, especially in horticulture, it may be used to advantage. Spreading a layer of sand or gravel over humus soils causes a rise in the temperature of the latter, and wholly or partially prevents the frequent night frosts which occur during spring in such soils.[9]

Mulching with dead organic matter (stable manure, straw, etc.) may be used to lower the temperature of the soil during the warm portion

[1] Forsch. Agr. Phys. [Wollny], 4 (1881), p. 147.

[2] Ibid., 19 (1896), p. 305; 20 (1897-98), p. 133.

[3] E. S. R., 6, p. 764.

[4] Forsch. Agr. Phys. [Wollny], 5 (1882), p. 186.

[5] Ibid., p. 1.

[6] Ibid., 3 (1880), p. 343.

[7] Ibid., 1 (1878), p. 43; 4 (1881), p. 327.

[8] Ibid., 20 (1897-98), p. 324.

[9] Ibid., 17 (1894), p. 245.

of the year. By the same means the influence of the temperature of the air is diminished, and the soil protected from all excessive changes in temperature.[1] This is due to the fact that all the materials mentioned are poor conductors of heat. Allowing stable manure to remain spread out during the warm months on the surface of the soil for some time before it is worked into the soil may unfavorably affect the moisture of the soil. In the colder portion of the year, however, it may be beneficial on account of its influence in raising the temperature of the soil. Under such condition, however, the covering of manure may exercise a harmful influence on fine-grained clay soils rich in humus by preventing the loosening effect of frosts,[2] which is so important for such soils. Beneficial results may be obtained by thinly spreading a mulch in the late fall over fields occupied by perennial forage plants, thus protecting the plants against low, and especially changeable winter temperatures. As, however, such a covering retards warming of the soil, the undecomposed remains of the mulch should be removed as soon as the temperature begins to rise in the spring.

Keeping in mind the fact that covering the soil in this manner retards warming in spring, this practice may also be utilized to retard the blossoming of fruit trees, thus diminishing or preventing damage from late frost. If the ground surrounding the trunk is covered in spring with a heavy layer of straw, the temperature is kept low and in consequence the amount of water received through the roots is small, so that the development of the leaves, and especially the blossoms, is retarded for several weeks, or until the organs of reproduction are then in little danger of freezing.

Finally, the practice of keeping fields fallow (i. e., without crops) is a means of increasing the temperature of the soil during the warm season. When the rise in temperature is accompanied by an increase in the water content of the soil decomposition of organic materials is promoted,[3] and a greater or less quantity of plant food is stored in the soil. The only danger is that in permeable soils this plant food may be leached beyond the reach of the plants by heavy rains.

---

[1] E. S. R., 6, p. 959.

[2] Forsch. Agr. Phys. [Wollny], 20 (1897-98), p. 447.

[3] E. S. R., 4, p. 632.

RECENT WORK IN AGRICULTURAL SCIENCE.

CHEMISTRY.

A new method for the direct determination of alumina in the presence of iron, manganese, calcium, and magnesium, W. H. Hess and E. D. Campbell (*Jour. Amer. Chem. Soc., 21 (1899), No. 9, pp. 776-780*).—The authors found phenylhydrazine to be the most satisfactory of a long list of organic bases tried for the precipitation of the alumina. It precipitates the alumina from its solutions quantitatively, and, being a strong reducing agent, quickly reduces iron to the ferrous state, thus playing a double rôle. In carrying out the method the alumina solution, preferably in the form of chlorid, is heated to near the boiling point, dilute ammonia added slowly as long as the precipitate formed just redissolves with readiness, and a neutral saturated solution of ammonium bisulphite (made by passing sulphur dioxid into a cooled solution of ammonia, 1:1, until the solution becomes yellow) is added drop by drop to the hot solution until it becomes colorless, showing the complete reduction of the iron. To the hot solution 1 or 2 cc. of phenylhydrazine is added. If this does not suffice to produce a permanent precipitate, dilute ammonia may be added drop by drop until a permanent precipitate is just perceptible, and the precipitation then completed with a few drops more of the phenylhydrazine. The solution is filtered and the precipitate washed with warm water containing 5 to 10 cc. of phenylhydrazine bisulphite in 100 cc. of water, until the washings show no iron with ammonium sulphid. The bisulphite is made by adding a saturated aqueous solution of sulphur dioxid to phenylhydrazine until the crystals of phenylhydrazine sulphite which at first appear are redissolved to a yellow solution. This concentrated solution if well stoppered will keep indefinitely.

The precipitate with the filter is ignited in a platinum crucible and weighed. As the precipitate is very hygroscopic a second ignition and weighing is necessary. The phosphorus pentoxid determined in a separate sample is subtracted from the weight of the precipitate.

The iron may be determined in the filtrate from the alumina precipitate by precipitating with ammonium sulphid, redissolving the precipitate in dilute hydrochloric acid, and estimating in the usual way with ammonia after oxidation with nitric acid.

The phosphoric acid may be estimated by precipitating with phenylhydrazine, a sufficient amount of an excess of aluminum chlorid being added if the substance does not contain sufficient alumina to carry all the phosphoric acid as the normal phosphate. The precipitate may be dissolved in nitric acid and the phosphoric acid determined in the usual way, or it may be ignited and weighed, giving the combined weights of the alumina added and of the alumina and phosphoric acid in the substance. A number of determinations in known mixtures show very satisfactory results.

The estimation of arsenic in Paris green, T. SMITH (*Jour. Amer. Chem. Soc., 21 (1899), No. 9, pp. 769–772*).—The author proposes the following method: Two grams of Paris green is boiled for a few minutes with 100 cc. of water and 2 gm. of sodium hydroxid, allowed to cool to room temperature, made to 250 cc., filtered through a dry filter, and 50 cc. of the solution taken for analysis. The aliquot is concentrated to about half its volume, an equal volume of strong hydrochloric acid and 3 gm. of potassium iodid added, and the whole allowed to stand for 10 minutes. The deep-red solution is slightly diluted with water to dissolve the precipitate caused by the potassium iodid, and a dilute solution of sodium hyposulphite added until the color just disappears. The solution is then neutralized with dry sodium carbonate, and an excess of sodium bicarbonate added. The solution is then titrated with a decinormal iodin solution, or better, one in which 1 cc. of solution is equivalent to 0.005 gm. of arsenic trioxid. The number of cubic centimeters of such a solution multiplied by 1.25 gives the percentage of arsenic trioxid in the Paris green. With this method the author obtains duplicates differing within 0.05 per cent, and the results check very closely with the gravimetric methods. Less than an hour is required for an analysis.

Determination of dextrose in the presence of cane sugar, JESSEN-HANSEN (*Medd. Carlsberg Lab., 4 (1899), p. 314; abs. in Chem. Ztg., 23 (1899), No. 74, Repert., p. 273*).—The author has made many experiments in the line of those of Kjeldahl, and prepared tables for the calculation of dextrose in mixtures of dextrose and cane sugar. He finds that with slight modifications of the conditions described by Kjeldahl useful results may be obtained. If twice the amount of potassium-sodium tartrate prescribed by Kjeldahl is employed and the time of heating shortened to 5 minutes, only about 14 mg. of copper will be thrown down by 10 gm. of cane sugar (instead of 110 mg. as under the former conditions), and if the time is measured exactly concordant results will be obtained.

Studies on malic acid, HILGER and H. LEY (*Chem. Ztg., 23 (1899), No. 80, p. 584*).—The chemical characteristics of malic acid prepared from the fruit, berries, and other parts of various plants was studied, and also the method of quantitative determination. Palladious chlorid was found to be a means for the determination of malic acid in the presence of tartaric acid, etc., especially in wine. With the exception of glycerin no normal constituent reduces alkaline palladious chlorid, while malic acid separates out the metallic palladium after 10 minutes' boiling. This can be collected in an Allihn's tube and weighed direct. In determining malic acid in wine the wine is evaporated to about one-third, the acids precipitated with lead acetate, and the precipitate redissolved by hydrogen sulphid or carbonic acid.

A contribution to the chemistry of butter fat. II, Chemical composition of butter fat, C. A. BROWNE, Jr. (*Jour. Amer. Chem. Soc., 21 (1899), No. 10, pp. 807–827*).—Continuing his previous investigations (E. S. R., 11, p. 308), the author has analyzed the soluble and insoluble fatty acids, and studied the glycerids of butter fat. He gives the methods and results, together with notes on the accuracy of the methods employed.

Composition of butter fat.

	Acids.	Triglycerids.
	Per cent.	*Per cent.*
Insoluble acids:		
Dioxystearic	1.00	1.04
Oleic	32.50	33.95
Stearic	1.83	1.91
Palmitic	38.61	40.51
Myristic	9.89	10.44
Lauric	2.57	2.73
Soluble acids:		
Capric	.32	.34
Caprylic	.49	.53
Caproic	2.09	2.32
Butyric	5.45	6.23
Total	94.75	100.00

"Other bodies, such as coloring matter, lecithin, cholesterin, phytosterin, etc., which occur in butter fat in only minute quantities, have not been considered in the above analysis. These substances go to make up the unsaponifiable matter of butter fat, the total amount of which we have found to be only about 0.1 per cent.

"We have made an elementary analysis of butter fat and find the agreement between the actual percentages of carbon, hydrogen, and oxygen, and the theoretical figures, as calculated from the percentages of the various glycerids in the preceding table, to be very close.

Elementary composition of butter fat.

	Carbon.	Hydrogen.	Oxygen.
	Per cent.	*Per cent.*	*Per cent.*
Actual	75.17	11.72	13.11
Theoretical	74.86	11.71	13.43

"The close agreement between these two sets of results would indicate that the figures expressing the percentages of acids and glycerids are not very far removed from the truth. . . .

"While the evidence is strongly in favor of the existence of complex glycerids, there are equally good reasons for believing in the existence of simpler bodies. An analysis of the fatty acids from the different fractions of the butter oil and butter palmitin would throw much light upon the constitution of the glycerids contained therein. For such work, however, our time has been too limited. We hope, if possible, in the future to continue our work in this direction."

A contribution to the chemistry of butter fat. III, The chemistry of rancidity in butter fat, C. A. BROWNE, Jr. (*Jour. Amer. Chem. Soc., 21 (1899), No. 11, pp. 975–994*).—The term rancidity is used to mean not merely a development of free acid, but any chemical or physical change in the character of a fat from the normal. The author points out the distinction between rancid butter and rancid butter fat. The present investigations were confined entirely to pure butter fat and not to butter.

The changes undergone by a sample of butter fat during 8 months are given, showing that with the development of rancidity there was a decided increase in the acid, saponification, and Reichert numbers, a slight increase in the ether number, and a very marked decrease in the iodin absorption. Additional data for 4 samples of fresh and rancid butter fat show that with the advance of rancidity there is an increase in the acetyl number and a decrease in the percentages of insoluble acids and glycerol.

The effects of rancidity upon the acids of butter fat are discussed at considerable length. Elementary analyses of fresh butter fat and rancid butter fat 2 years old showed "that the effect of rancidity is to cause a decrease in the percentages of carbon and hydrogen, with a corresponding increase in the percentage of oxygen."

The increase of the saponification number as rancidity advances is explained by the breaking up of higher acids into acids of lower molecular weight, which is confirmed by the decrease in percentage of insoluble acids and the increase in the Reichert number. Little difference was found in the majority of experiments between the molecular weights of the volatile acids from fresh and rancid samples, the general tendency seeming to be toward a slight decrease in this constant as the butter fat became rancid.

"In the development of acidity there seems to be a gradual breaking up of all the glycerids," although the first change is apparently an oxidation of some of the oleic acid. The author notes that the amount of free volatile or soluble acids in rancid butter fat is much smaller than might be expected, and states in explanation of this that "the first products formed by the decomposition of oleic acid are not of an acid but of an aldehyde nature. These aldehyde bodies are further changed by oxidation into soluble acids, but this takes place only in a very advanced stage of rancidity." In the process of saponification with alcoholic potash these aldehydes are decomposed into acids. This also is given as an explanation of another fact, namely, the increase in the ether number with rancidity, while theoretically the quantity of neutral fat (represented by ether number) should become steadily less. The presence of aldehydes vitiates the true ether number. The following table is given as showing the probable manner in which the oleic acid of butter fat is decomposed:

Decomposition of oleic acid in butter fat.

Butter fat.	Condition.	Oleic acid.	Insoluble acids.	Loss in oleic acid.	Loss in insoluble acids.	Acetyl number.	Increase in acetyl number.	Increase in oxy-acids.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*			*Per cent.*
No. 1	Fresh	38.28	88.96	....	....	3.5	....	....
No. 1	Rancid	31.85	85.06	6.43	3.90	10.9	7.4	1.78
No. 2	Fresh	32.81	86.41	....	....	4.1	....	....
No. 2	Rancid	21.93	80.42	10.88	5.99	15.1	11.0	2.51
No. 3	Fresh	38.76	88.46	....	....	3.8	....	....
No. 3	Rancid	25.03	81.15	13.73	7.31	18.0	14.2	3.28
No. 4	Fresh	38.79	87.72	....	....	....	....	....
No. 4	Rancid	9.49	72.03	29.30	15.69	....	....	....

"The loss in insoluble acids accounts for but little more than half the loss in oleic acid; the ratio seems to be a fairly constant one, and averages about 55 per cent. This figure, then, may be taken to represent approximately the amount of oleic acid in the loss which is converted into lower soluble acids. Calculating the increase in the acetyl numbers to dioxystearic acid will make up about 25 per cent more of this loss in oleic acid, thus leaving about 20 per cent still unaccounted for; the formation of insoluble aldehyde products during the saponification may explain this discrepancy."

The reason for the decrease in the percentage of glycerol as rancidity advances is discussed without arriving at any satisfactory explanation. The effects of rancidity upon the physical constants of butter fat are shown, there being an increase in the specific gravity, something of a decrease in the temperature at which turbidity appears (critical temperature), and an increase in the refractive index. The combustions in a bomb calorimeter showed a marked decrease in the heats of combustion of rancid fat.

Report of chemist, R. HARCOURT (*Ontario Agr. Col. and Expt. Farm Rpt. 1898, pp. 19–29*).—A summary account of the work of the chemist during the year, including especially analyses of fertilizers, oat grains and hulls (food constituents), and roots and tops of common red, mammoth, and alsike clover, and alfalfa at different stages of growth (fertilizing constituents), and a study, including digestion experiments, of the effect of the stage of growth on the composition of alfalfa (see p. 662).

Chemistry: Its evolution and achievements, F. G. WIFCHMANN (*New York: William R. Jenkins, 1899, pp. 176*).—The author discusses the growth of chemistry from the early alchemists to the present time. The great discoveries and the more important theories are spoken of, and much historical matter gathered from a variety of sources is brought together in concise form. A somewhat detailed name and subject index adds to the usefulness of the volume.

Plant and agricultural chemistry, M. BERTHELOT (*Chimie végétale et agricole. Paris: Masson & Co., 1899, vols. 1, pp. XVI+511, figs. 4; 2, pp. VI+441, figs. 3; 3, pp. VI+517, figs. 6; 4, pp. VI+528, figs. 2*).—This book is a collection of the reports of the work of the author, especially at the station for plant chemistry at Meudon, which have appeared from time to time in the *Annales de Physique et Chimie*. The first volume deals with the fixation of free nitrogen by soils and by plants, the second volume is devoted to general studies on plant growth and the chemical action of light, the third includes special studies on plant growth, and the fourth is devoted to studies of cultivated soils and of wine and its bouquet. Of the many valuable papers included in these volumes those relating to the author's noted investigations on the fixation of the free nitrogen of the air by soils and plants are especially interesting and important.

Dairy chemistry: A practical handbook for dairy chemists and others having control of dairies, H. D. RICHMOND (*London: Chas. Griffin & Co. Ltd., 1899, pp. 384, figs. 22*).—This is a comprehensive treatise on the chemistry of milk and dairy products and the methods of analyzing them and of conducting dairy inspection. The 8 chapters treat of the constituents of milk, the analysis of milk, adulterations and alterations of normal milk and their detection, chemical control of the dairy, biological and sanitary matters, butter, other milk products, and the milk of mammals other than the cow. A large number of useful tables are incorporated in the body of the book and in an appendix, and a chapter is added on the standardization and calibration of apparatus. The author is the analyst to the Aylesbury Dairy Company and is well known as a dairy chemist. The large amount of analytical data and observations accumulated by his predecessor, Dr. Vieth, during the period of 12 years in which he occupied the position of analyst in the above company, has been made use of in preparing the book.

Dictionary of industrial chemistry in its relation to manufacturing, metallurgy, agriculture, pharmacy, pyrotechnics, arts, and manufactures, A. M. VILLON and P. GUICHARD (*Dictionnaire de chimie industrielle, contenant les applications de la chimie a l'industrie, a la métallurgie, a l'agriculture, a la pharmacie, a la pyrotechnie et aux arts et métiers. Paris: Tignol, 1899, vol. 2, pp. 104, ill.*).

Practical manual of the analysis of alcohols and spirits, C. GIRARD and L. CUNIASSE (*Manuel pratique de l'analyse des alcohols et des spiritueux. Paris: Masson & Co., 1899, pp. VIII+445*).

A quarterly review of the progress in medical chemistry, T. PANZER (*Oesterr. Chem. Ztg., 2 (1899), No. 15, pp. 363, 364*).—The greater part of this article is devoted to a review of the recent work on albuminoids.

Guide to the chemical analysis of alimentary substances, A. GADOLA (*Guida per le recerche chimiche sulle sostanze alimentari. Caserta: S. Marino, 1899*).

Chemistry of essential oils and artificial perfumes, E. J. PARRY (*London: Scott, Greenwood & Co., 1899, pp. 411, figs. 20*).

On the volumetric determination of zinc, POUGET (*Compt. Rend. Acad. Sci. Paris, 129 (1899), No. 1, pp. 45-47*).

Basis for the examination of butter by the refractometer, A. PARTHEIL (*Chem. Ztg., 23 (1899), No. 80, p. 584*).—Pure preparations of the principal constituents of butter fat were tested in the refractometer. The values obtained indicate that the parallelism observed in practice between the iodin number and the index of refraction rests upon a scientific basis, but that no parallelism was apparent between the Reichert Meissl number and the index of refraction or the temperature coefficient for the reaction.

Cryoscopy of butter and margarin, POURET (*Bul. Soc. Chim. Paris, 3. ser., 22 (1899), No. 15, pp 738-740*).

Determination of acidity of must, wines, and vinegars by eudiometric method, A. BERNARD (*Bul. Soc. Nat. Agr. France, 59 (1899), No. 7, pp 505-510*).

The examination of malt, L. AUBRY (*Chem. Ztg., 23 (1899), No. 80, pp. 849, 850*).—A description of methods.

The accuracy of the Jorgensen method of estimating boric acid in preserved meat and the separation of the boric acid and borax, A. BEYTHIEN and H. HEMPEL (*Ztschr. Untersuch. Nahr. u. Genussmtl., 2 (1899), No. 11, pp. 842-851*).

A chemical study of wheat, C. B. FRANKFORTER and E. P. HARDING (*Jour. Amer. Chem. Soc., 21 (1899), No. 9, pp. 758-769*).—This investigation relates to wheat oil—its viscosity, index of refraction, absorption spectrum, saponification number, iodin number, and acid number, and the determination of glycerol, lecithin, and parocholesterol.

The chemical changes in rye and wheat during molding and sprouting, R. Scherpe (*Ztschr. Untersuch. Nahr. u. Genussmtl., 2 (1899), No. 7, pp. 550–558*).– The investigation covers changes in weight of the dry matter, nitrogen, starch, water-soluble carbohydrates (those soluble by the aid of diastase), pentosans, cell material, fat, and ether extract. In addition the acidity, ammonia, water soluble substance, together with its nitrogen and ash content, water-soluble carbohydrates, the nitrogen of pure protein, and the fat and ether extract were studied more especially from a chemical standpoint.

Chemical examination of tobacco smoke, H. Thoms (*Chem. Ztg., 23 (1899), No. 80, pp. 852–854*).—A paper presented at the Munich meeting of the Association of German Naturalists and Physicians. The points investigated were (1) the nicotin and ash content of the cigars used, (2) what bases pass into the smoke? (3) what acids are formed during smoking? (4) what is the nicotin content of the cigar stub remaining after smoking? and (5) does tobacco smoke contain carbonic oxid or other poisonous body?

On the occurrence of barium in plants and in soils, R. Hornberger (*Landw. Vers. Stat., 51 (1899), No. 6, pp. 473–478*).—The ash of the trunk wood of 2 copper beeches, 102 and 105 years old, was found to contain from 0.97 to 1.2 and 0.57 to 0.9 per cent of barium oxid (BaO), respectively. Four hundred grams of the soil on which these trees grew, extracted with hot 5 per cent hydrochloric acid, yielded 9 mg. of barium sulphate. Similar observations by other investigators are noted.

The occurrence of chlorin-containing organic compounds in cotton-seed oil, and the nonexistence of sulphur-containing bodies in the same, P. N. Raikow (*Chem. Ztg., 23 (1899), Nos. 75, pp. 769, 770; 77, p. 802*).

Further investigations on the volatile mustard oil prepared from a number of samples of rape-seed cake, G. Jörgensen (*Landw. Vers. Stat., 52 (1899), No. 4, pp. 269–290*).

Hazel-nut oil, J. Hanuš (*Ztschr. Untersuch. Nahr. u. Genussmtl., 2 (1899), No. 8, pp. 617–622*).—The author reports a study of the composition of this oil

Formation of furfurol from starch and its derivatives, F Sestini (*L'Orosi, 20 (1898), p. 325; abs. in Analyst, 24 (1899), No. 279, p. 157*).

On the constitution of vegetable alkaloids, X. Causse (*Ann. Univ. Lyon, n. ser., 1 (1899), No. 2, pp. 99*).

Carbon bisulphid (*L'Engrais, 14 (1899), No. 42, pp. 1000–1002*) —A discussion of its properties, manufacture, uses, and application in agriculture and viticulture.

Some boiling point curves, II, J. H. Haywood (*Jour. Amer. Chem. Soc., 21 (1899), No. 11, pp. 994–1001*).—The author has worked out the curves for mixtures of benzene or methyl alcohol with chloroform, carbon tetrachlorid, ether, and acetone.

Rise and development of the liquefaction of gases, W. L. Hardin (*New York: Macmillan Co., 1899, pp. 250, figs. 42*).

Indicators and test papers—their source, preparation, application, and tests for sensitiveness, A. I. Cohn (*New York: John Wiley & Sons; London. Chapman & Hall, Ltd., 1899, pp. IX+249*). –The title page states that this is "a résumé of the current facts regarding the action and application of the indicators and test papers which have been proposed from time to time, and are in present use in chemical manipulations, with a tabular summary of the application of indicators, designed for the use of chemists, pharmacists, and students."

Apparatus for preventing the backward flow of water during exhaustion with a water-pump, G. Chatanay (*Jour. Pharm. et Chim., 6. ser., 9 (1899), No. 11, pp. 524–527, fig. 1; abs. in Jour. Chem. Soc. [London], 76 (1899), No. 444, II, p. 646*).

The physical-chemical laboratory of the University of Giessen, K. Elbs (*Chem. Ztg., 23 (1899), No. 76, pp. 766–768, figs. 4*).—A description with plans.

State analytical laboratories, J. Graftiau (*Ann. Sci. Agron., 1899, II, No. 1, pp. 122–129*).

METEOROLOGY.

Monthly Weather Review (*U. S. Dept. Agr., Weather Bureau, Monthly Weather Review, 27 (1899), Nos. 7, pp. 287–341, pls. 3, figs. 6, charts 8; 8, pp. 343–393, pls. 2, figs. 2, charts 12; 9, pp. 395–448, fig. 1, charts 11*).—In addition to the usual reports on forecasts and warnings and on weather and crop conditions, and meteorological tables and charts, No. 7 contains special contributions on Cold waves in the Southwest, by J. S. Hazen; Every man his own weather prophet, by J. H. Hopkins; A study of temperatures at Baltimore, Md., by F. J. Walz; Special report on the flood in the Brazos River Valley, Texas, June 27 to July 15, 1899, with notes of previous overflows of the Brazos (illus.), by I. M. Cline; Volcanic eruptions in Hawaii, by C. J. Lyons; The tornado at New Richmond, Wis. (illus.), by O. G. Libby; The use of the storage battery for the electrical recording instruments, by E. C. Vose; Irrigation by wire, by A. Betts; Climatology of the Isthmus of Panama, by H. L. Abbott; Tornado observations, by A. H. Gale; The force of a tornado, by B. F. Groat; Sudden oscillations in lake level—pressure waves (illus.), by A. J. Henry; and Tornado, hurricane, and cyclone, by H. M. Watts; and notes by the editor on effect of wind, on catch of rainfall, seismograph stations in the United States, temperatures in the sunshine, destructive frost of June 30, 1899, in Ohio, chalk-plate maps, tornado phenomena, local winds that are not tornadoes, spurious tornado photographs, general forecasts for Washington, Oregon, and Idaho, the present status of meteorology, the diurnal variation of the barometer, and river discharges in Colorado.

No. 8 contains special contributions on Waterspouts at Key West, Fla. (illus.), by H. R. Boynton; Water temperatures of the Great Lakes, by N. B. Conger; Conduct and the weather,[1] by E. G. Dexter; Automatic records of a thunderstorm (illus.), by H. H. Kimball; Thunderstorms on August 2, 1899 (illus.), by A. J. Henry; and notes by the editor on a newspaper tornado fake, display of forecast cards on street letter boxes, improvements in map of the section reports, chemistry of vegetation, the direction of rotation, standard time, the ether and the atmosphere, from Honolulu to Iowa, do local storms follow river valleys? Weather Bureau men as university lecturers, the weather and the dairy, ball lightning, fillet or ribbon lightning, distant lightning, the storms of August 2, air currents in thunderstorms, ancient tornado tracks, the second Wellman expedition, and a successor to Senor Barcena (Manuel E. Pastrana).

No. 9 contains special contributions on The origin, paths, and limiting zones of the typhoons of the Orient, by P. Bergholz (translated by C. Abbe); The international cloud work of the Weather Bureau, by F. H. Bigelow; Floods and flood problems, by H. C. Frankenfeld; Small whirling columns of mist, by R. B. Marean; Additional observations of the St. Kitts, W. I., hurricane, by W. H. Alexander; and Proceedings of the meeting of the International Meteorological Committee, at St. Petersburg, September 2-7, 1899, by A. Lancaster; and notes by the editor on results of work with balloons and kites at Trappes, France (illus.), preliminary results of Weather Bureau kite observa tions in 1898, the average temperature of the atmosphere, the International Electrical Congress at Como, Italy, instructive laboratory experiments (on the dynamics of the air), meteorology in our universities, Weather Bureau men as university lecturers, minimum temperatures on mountain peaks, August weather on the Pacific Coast, the calculation of the resultant wind, and probable cloudiness during total solar eclipse of May 28, 1900 (see below).

---

[1] Abs. from Psych. Rev., Monograph Sup. No. 10, pp. 104.

Report of the Chief of the Weather Bureau for 1899, W. L. MOORE (*U. S. Dept. Agr., Weather Bureau Doc. 206, pp. 23*).—This is a report of the operations of the Weather Bureau during the fiscal year ended June 30, 1899. In addition to a general summary of the work of the year, this report discusses briefly the West Indian service; the convention of Weather Bureau officials at Omaha, Nebr., October 13-14, 1898; loss of life and property in the United States by lightning in 1898; meteorological charts of the Great Lakes; aerial observations; international cloud observations; plateau barometry; climate and crop work; Monthly Weather Review; California rainfall and Alaskan temperatures; distribution of forecasts and warnings, and a number of other less important topics.

Meteorology, J. B. REYNOLDS (*Ontario Agr. Col. and Expt. Farm Rpt. 1898, pp. 2, 3*).—Tridaily observations on dew point and humidity during 5 months (June-October) of 1898 are reported and briefly discussed.

About the weather, M. W. HARRINGTON (*New York: D. Appleton & Co., 1899, pp. XX+246, pl. 1, figs. 48*).—This is the first of a series of "Home Reading Books" edited by W. T. Harris, U. S. Commissioner of Education. The subjects discussed are: The contest of mankind with the weather; remedies against injuries by weather; pressure of the air and its measurement; kinds, distribution, velocity, and measurement of winds; temperature; humidity or moisture—dew, fog, cloud, rain, and snow; cyclones or lows and anticyclones or highs and the weather accompanying them; tornadoes; ice, sleet, ball snow, and hail; thunderstorms and cloud-bursts, lightning and thunder; diurnal and annual changes in weather; local influences on weather; weather predictions; progress of knowledge of the weather; simple experiments with air; familiar effects of weather changes.

In a brief introductory chapter the editor explains the plan and purpose of this series of books.

Vertical gradients of temperature, humidity, and wind direction, H. C. FRANKENFELD and C. F. MARVIN (*U. S. Dept. Agr., Weather Bureau Bul. F (Doc. 208), pp. 71, pls. 4, figs. 6*).—This is a preliminary report on kite observations at 17 stations in the United States during the year 1898, with an introductory chapter on the construction and operation of the kite meteorograph. "The temperature conditions at all elevations and under varying conditions of weather and time have been computed in terms of the gradient in degrees Fahrenheit for each 1,000 ft., and in the increase of elevation necessary to cause a fall of 1 degree in the temperature. The mean results, however, are given only in degrees per thousand feet."

The probable state of the sky along the path of total eclipse of the sun, May 28, 1900, observations of 1899, F. H. BIGELOW (*U. S. Dept. Agr., Weather Bureau Bul. 27, pp. 23, charts 4*).—This is the third report (E. S. R., 10, p. 827) on observations to determine the prevailing average cloudiness in the districts covered by the eclipse track.

The mild temperature of the Pacific Northwest and the influence of the "Kuro Siwo," B. S. PAGUE (*Portland, Oreg.: Weather Bureau Print, 1899, pp. 11, charts 3*).—This paper, which is published by permission of the Chief of the U. S. Weather Bureau, undertakes to demonstrate that the mildness of the temperature of the Pacific Northwest is not due to the influence of the Kuro Siwo, or Japan current, but is a result of the dynamic heating due to compression of the air descending the Pacific slope.

Variations in lake levels and atmospheric precipitation, A. J. HENRY (*U. S. Dept. Agr., Weather Bureau Doc. 203, pp. 8, dgms. 3*).—This article summarizes the records of past years with a view to showing whether there is any definite relation between precipitation and the average level of the Great Lakes.

It is stated that "it seems possible to indicate the level of the Lakes, approximately at least, by closely observing the precipitation in the various watersheds, especially the amount of snow and the manner of its disappearance. All inferences as to the probable effect of precipitation on Lake levels must be contingent, however, upon the maintenance of a constant cross section and slope in the present connecting channels."

An advance in measuring and photographing sounds, B. F. SHARPE (*U. S. Dept. Agr., Weather Bureau Doc. 202, pp. 18, pls. 7, figs. 3*).—An article reprinted from the *Monthly Weather Review, 27 (1899), No. 5, p. 205.*

The carbon dioxid of the ocean and its relations to the carbon dioxid of the atmosphere, C. F. TOLMAN (*Jour. Geol., 7 (1899), No. 6, pp. 585–618, figs. 6*).

WATER—SOILS.

Cooperative experiments in soil moisture, J. B. REYNOLDS (*Ontario Agr. and Expt. Union Rpt. 1898, pp. 57–60*).—A brief account is given of observations during one month on clay loam soil planted in turnips, light sandy loam in barley, and heavy clay in winter wheat.

The following method of taking samples of soil was used and proved very satisfactory:

"The apparatus consists of a brass tube 1 ft. long, with an inside thread cut at one end. Into this end fits an iron shank, about 3 ft. long, having a similar outside thread cut at one end and with a large eye at the other, into which a wooden handle fits. The other extremity of the brass tube is fitted with short curved steel knives, which serve the purpose of cutting out a tube of soil. [See also p. 625.] The sample is taken by a combination of boring and downward pressure and the tube of soil passes up the brass tube until the latter is filled. Then the filled tube is unscrewed from the shank, slipped into a tin case previously labeled, and the tin case is then corked tightly and put into a wooden box. The end of the box slides in and out of a snugly fitting groove, and when the box is thus closed there is little chance for the moisture to escape from the soil within.

"After the first tube has been removed from the shank a second is screwed on and a second boring is made just below the former, and after that a third. It has been our practice so far to take 3 depths—2 a week; and as the wooden box will contain just 6 tubes each box represents 1 week's work. When filled the box is shipped to the laboratory for the determination of the moisture content."

The sediment content of irrigation water J. D. KOBUS (*Meded. Proefstat. Oost Java, 3. ser., No. 14, pp. 24*).—Observations on the sediment content of a large number of samples of water taken at different dates from 6 sources of supply for irrigation purposes are reported. The average amount of sediment in the 6 cases varied from

131 to 422 mg. per liter. The phosphoric acid in the sediment varied from 0.3 to 1.7 per cent; potash from 0.21 to 0.6 per cent; the nitrogen from 0.16 to 0.4 per cent.

Contributions to the study of Russian soils, A. SOVIETOV and N. ADAMOV (*St. Petersburg, 1899, pt. 12, p. 137; rev. in Selsk. Kohz. i Lyesov., 193 (1899), June, pp. 718, 719*).—Of the articles in this publication two are of especial interest. The first, The phenomena of reaction between the mineral and organic parts of the soil, by P. Lyashchenko, gives the results of investigation on the chemical properties of humus These investigations corroborate the view advanced earlier by some scientists that humus is capable of decomposing mineral salts, both soluble and insoluble, and also natural minerals. The author finds that the admixture of salts with the humic substances increases this decomposition. Thus the reaction between the mineral and organic parts of the soils may be considered as a simple chemical reaction, which, among other things, fully explains the vegetable origin of chernozem.

The second article, The development of the root system in plants in dependence on the concentration of the soil solutions, by S. Kravkov, reports experiments which lead to the conclusion that there is a regular correlation between the concentration of the aqueous solution of the soil and the life of the roots (of barley). The author concludes that the roots of plants usually depend for their nourishment entirely upon the materials in solution in the soil, and only make use of their ability to take up plant food from the solid particles of the soil by means of acid secretions under unusual conditions or at critical periods of the life of the plant.—P. FIREMAN.

Some methods for the determination of the productiveness of soils, W. W. WINNER (*Izv. Moscow Selsk. Khoz.-Inst., 5 (1899), No. 2, pp. 117-144*).—The author explains his method of making a soil survey of an extended area. For this purpose a large number of samples of soil are taken and observations on topography and surface geology of the locality and the physical characteristics of the different soil layers are made, the level of the ground water, etc., being at the same time recorded. The samples so collected are classified as regards their more important features. The separate groups are then subjected to a preliminary examination with a view to more accurate classification and the selection of the samples requiring detailed examination. In this preliminary examination determinations are made of (1) the undecomposed mineral matter ("skeleton") of the soil, (2) the products of weathering (clay and zeolites), and (3) the humus content. The first throws light on the origin of the soil, the second and third on its formation and present condition.

The separation of the clay and zeolites from the undecomposed "skeleton" presents great difficulties. For the estimation of the former the author prefers a method based on the determination of chemically combined water. Chemically combined water is a necessary constituent not only of clay, but of all its components, namely, of zeolites and hydrated combinations of oxid of iron, alumina, and silicic acid; and in these substances the water content fluctuates within narrow limits (10 to 20 per cent), approaching that of kaolin, which, according to the formula Al_2O_3, $2SiO_2$, $2H_2O$, is about 14 per cent.

The chemically combined water is determined by subtracting from the total loss on ignition the weights of the humus and of the hygroscopic water. From the amounts of chemically combined water thus determined the proportions of zeolites and clay in the soil are estimated.

This method was compared with the mechanical method on 6 different soils. The average content of clay by the mechanical method was 11.4 per cent, by the author's method 11.2 per cent. The agreement was close, except in case of sandy and very clayey soils. The author's investigations indicate that with such soils the mechanical method gave too low results. On the whole, the combined-water method gave very satisfactory results on clayey, medium, and sandy soils.

The determination of humus presents little difficulty, and skeleton may be determined by difference. It is sometimes desirable in addition to the above to determine carbonates and soluble salts (alkali), but this is easily done.

By means of the preliminary examination the number of samples requiring detailed examination is greatly reduced. In the latter the same objects are kept in view as in the preliminary study, viz, the origin, processes of formation, and present condition of productiveness.

Conclusions as to the first two points are based upon the field and geological observations and upon (1) changes in the mechanical composition of the skeleton, as determined by comparing the mechanical composition of the subsoil, soil, and the intermediate horizon; (2) the degree of the weathering of the soil, as compared with parent rock, as determined by the data as to the chemically combined water; (3) the changes in the composition of the products of the weathering, as determined by the amount and composition of the zeolitic portion of the soil and subsoil; (4) the changes in the contents of carbon dioxid in different horizons, and (5) the distribution of organic matter in the various horizons. To ascertain these and many other features recourse must be had to the most varied methods.

For testing the productiveness of the different soils the author uses the so-called "culture method." This consists of testing the soils in pots under different crops with and without fertilizers. In experiments with 6 different soils on which oats, vetches, and millet were grown the crops showed an increase of yield, due to fertilizers inversely proportional to the richness of the soil, the richness of the soil being measured by the amount of humus and clay present. The author holds that the productiveness of soils is a resultant of two mutually opposing factors, richness and activity of soils, the activity of soils being measured by the proportion of sand particles larger than 0.01 mm.

In laboratory experiments undertaken with the object of determining the energy of the decomposition of humus and the formation of nitrates it was found that the formation of carbon dioxid was inversely proportional to the humus content of the soil, and that the smaller the nitrogen content of the soil the more energetic (relatively) the formation of nitrates.—P. FIREMAN.

Determination of soil moisture, J. B. REYNOLDS (*Ontario Agr. Col. and Expt. Farm Rpt. 1898, pp. 3, 4*).—The methods of taking samples and determining moisture are briefly described. "The sampler used consists of a seamless brass tube 1 ft. in length and ⅞ in. in diameter, with a female thread at one end. To fit this, an iron shank about 3 ft. long, with a similar thread outside was made. Through the top of the shank a wooden handle 2 ft. long passed to serve as a lever in turning the instrument and boring into the soil. Into the other extremity of the brass tube were fixed 2 closely fitting knives, about ½ in. long, made of the hardest steel, and slightly curved so as to cut out a tube of soil somewhat smaller than the brass tube through which the soil passes."

Analyses of rose soils, W. FREAR and C. P. BEISTLE (*Amer. Gard., 20 (1899), Nos. 261, p. 872; 262, p. 894*).—Mechanical and chemical analyses (including solubility in 1 per cent citric acid) of 3 samples of soil used for culture of roses are reported, and their adaptability to the purpose for which they are used is briefly discussed.

The effect of surface cultivation on the moisture of the soil, J. B. REYNOLDS (*Ontario Agr. Col. and Expt. Farm Rpt. 1898, pp. 4, 5*).—This is an account of observations during May, June, and July on the moisture content (at depths of 1, 2, and 3 ft.) of plats, 1 rod square, on some of which the soil was kept loose and on the rest compact. The conclusions reached are that "(1) surface cultivation conserves moisture, and the drier the weather the greater is the relative effect; and (2) surface cultivation keeps the ground in better condition for lifting the water from below to the roots of plants."

FERTILIZERS.

On the relative value of street sweepings and farmyard manure, S. RHODIN (*K. Landt. Akad. Handl., 38 (1899), No. 2, pp. 82–99*).—The author gives a general discussion of the character and value of street sweepings and their application for fertilizing purposes in different countries in the Old and New World. In order to determine what proportion of street sweepings from Stockholm, Sweden, was of actual manurial value and what was useless admixtures, a carload lot of the sweepings weighing 7,900 kg. was picked over. Ninety-one per cent of the sweepings was found to consist of materials like horse manure, wood ashes, animal and vegetable refuse matter, which are of direct fertilizing value. The rest, 9 per cent, was made up of useless admixtures like paper and pasteboard (2.5 per cent), rags (1.3 per cent), raw bones (0.9 per cent), straw and bast (0.8 per cent), glass (0.9 per cent), stoneware and chinaware (0.4 per cent), stone and slag (0.9 per cent), tin plate and tin cans (0.4 per cent), etc.

For the purpose of determining the actual fertilizer value of street sweepings as compared with different kinds of farmyard manure, experiments were made with peat manure, straw manure, and street sweepings on the experimental farm at Albano, Sweden. The peat manure was from the Stockholm street-car stables, in which peat is used as an absorbent. The straw manure was from cow stables mainly. The composition of these materials was determined by chemical analysis, as follows:

Composition of peat manure, straw manure, and street sweepings.

	Peat manure (per cub. meter of 550 kgs.).	Straw manure (per cub. meter of 687 kgs.).	Street sweepings (per cub. meter of 471 kgs.).
Soluble in 2 per cent hydrochloric acid:	*Kgs.*	*Kgs.*	*Kgs.*
Potash	3.55	2.90	2.00
Lime	1.26	2.90	22.00
Phosphoric acid	1.70	3.50	.95
Ammonical nitrogen	1.00	.64	.08
Organic nitrogen	2.00	4.50	3.30
Organic matter	86.60	127.00	93.00

The value of a cubic meter of the three materials, according to Swedish valuations of fertilizing materials, was $1.24, $1.83, and $1.17, respectively.

In studying the comparative fertilizing value of the fertilizers mentioned, a piece of land 1.8 acres in extent was divided into 9 equal plats, 3 of which received no manure, 3 straw manure, and 3 sweepings. Barley was grown on the plats in 1897 and oats in 1898. No manure was applied in 1898. On another field of 2.47 acres a similar division was made and the same fertilizers applied, with peat manure in addition. Beans were grown on this plat. The soil in case of both fields was a heavy clay. Seventeen loads of manure per acre were put on the barley field and 65½ loads on the bean field. The average results obtained are shown in the following summary table:

Yields per acre of barley, oats, and beans with different kinds of manure.

	Barley, 1897.			Oats, 1898.			Beans, 1898.		
	Grain.	Straw.	Net return.	Grain.	Straw.	Net return.	Beans.	Vines.	Net return.
	Lbs.	*Lbs.*		*Lbs.*	*Lbs.*		*Lbs.*	*Lbs.*	
Straw manure	2,661	3,567	$44.75	2,270	4,124	$51.72	4,434	5,155	$70.69
Peat manure	....	....	....	....	....	....	4,866	5,667	89.74
Sweepings	2,360	3,253	33.78	2,153	3,845	46.00	4,302	4,560	62.40
Unmanured	1,843	2,658	28.93	1,763	3,276	37.29	....	....	....

The figures given for net returns were obtained by deducting the cost of growing the crops and the cost of manure from the value of the product. It will be seen that even if street sweepings do not possess the high value of either peat manure or straw manure they are profitable fertilizing materials.

Favorable practical experience as to the application of sweepings as a farm manure on land of different character is cited.—F. W. WOLL.

On the effect of animal manures on marsh soils, P. HELLSTRÖM (*K. Landt. Akad. Handl., 33 (1899), No. 3, pp. 167–171*).—As a contribution to the question of the effect and relative value of manure from different farm animals on marshy soils, the author conducted pot experiments in zinc cylinders 30 cm. high and 25 cm. in diameter. The fertilizers applied were extracts of horse, sheep, and cow manure, liquid manure, and slaked lime. The manure extracts were either applied directly or after having been previously sterilized by boiling on 3 successive days for 30, 10, and 10 minutes, respectively. Each pot received the equivalent of 2.5 gm. of manure. Two pots were left unmanured. The pots were filled with soil from a new-broken marsh which had not been fertilized and had not grown any crop. Peas were planted in the boxes, and after germination were thinned to the same number of plants in each pot. The average results for the different fertilizations are shown in the following table:

Data for 10 pea plants grown with different fertilizers on marshy soil.

	Peas.	Vines.	Peas and vines.	Number of pods per 10 plants.	Average weight of peas.
	Grams.	*Grams.*	*Grams.*		*Gram.*
No manure	5.51	10.92	16.43	14	0.134
Lime	7.29	16.39	23.68	20	.162
Sheep manure extract	9.12	16.71	25.83	21	.160
Sheep manure extract, sterilized	6.84	13.26	20.10	14	.156
Horse manure extract	7.55	17.15	24.70	23	.161
Horse manure extract, sterilized	6.52	13.49	20.01	17	.138
Liquid manure	12.40	17.25	29.65	17	.165
Liquid manure, sterilized	9.88	16.82	26.70	21	.157
Cow manure extract	8.88	16.92	25.80	23	.163
Cow manure extract, sterilized	7.78	15.96	23.74	18	.158

The largest yields were obtained by applying extracts of sheep, horse, and liquid manure that had not been previously sterilized; in case of cow manure the result was less marked. It is evident, therefore, that sheep, horse, and liquid manure possess a fertilizing effect aside from the quantities of fertilizer constituents contained in them, viz, through the activity of bacteria that are found therein.—F. W. WOLL.

Analyses of commercial fertilizers, H. J. WHEELER, B. L. HARTWELL, and C. F. KENYON (*Rhode Island Sta. Bul. 56, pp. 9*).—Tabulated analyses and valuations of 46 samples of fertilizers.

Commercial fertilizers, M. A. SCOVELL, A. M. PETER, and H. E. CURTIS (*Kentucky Sta. Bul. 82, pp. 32*).—This includes a summary of the provisions of the fertilizer law, notes on the selection of fertilizers, and a list of all the fertilizers entered for sale in the State up to the time of the publication of the bulletin, July, 1899, with guaranteed analyses.

Tobacco as manure, G. FALIÈS (*Tabac, 19 (1899), No. 354, pp. 23*).—Analyses are given of the composted waste products obtained from tobacco manufacturing establishments which show this material to be richer in fertilizing elements than barnyard manure.

Dangerous sulphate of ammonia (*Bul. Agr. [Brussels], 15 (1899), No. 4, pp. 251, 252*).—Analyses are reported of 3 samples of sulphate of ammonia containing over 7 per cent of free acid (calculated as sulphuric).

FIELD CROPS.

Report of the experimentalist, C. A. ZAVITZ (*Ontario Agr. Col. and Expt. Farm Rpt. 1898, pp. 119–183, figs. 2*).—The details and results of culture experiments and variety tests with imported and home-grown grain, field roots, silage, and forage crops carried on in 1898 are given, in continuation of similar work previously reported (E. S. R., 10, p. 237).

The experimental plats for all crops were $\frac{1}{100}$ acre in size. In the variety tests with grains, seed was sown broadcast at the rate of 100 lbs. per acre.

Barley (pp. 122–126, 141, 142–148).—Nineteen two-rowed, 15 six-rowed, and 11 hulless varieties of barley were tested. The average yield for the two-rowed and six-rowed varieties was 66.25 bu. per acre, or more than 27 bu. per acre greater than in 1897. The average yield of the hulless varieties was 47 bu. per acre, or nearly 24 bu. per acre greater than in 1897. The weight of the different varieties in 1898 was also high; that of the two rowed and six-rowed varieties having an average of 53.3 lbs. per measured bushel and that of the hulless variety, an average of 63 lbs. per bushel. Mandscheuri, a six-rowed variety, gave the largest total yield of all the varieties tested in 1898, 77.6 bu. per acre. This variety has also given the best average yield of 8 varieties tested for 10 years, 65.02 bu. Two-rowed Italian, Jarman Selected Beardless, Kinna Kulla, and Vermont Champion gave the best returns among the two rowed varieties tested, all yielding more than 68 bu. per acre. Hog, Purple, Guy Male, and Black Hulless gave the best yields of the hulless varieties, each exceeding 50 bu. per acre. In a test of seeding barley broadcast and with a seed drill on 6 different dates, the best average results were obtained by seeding with the drill April 22–25. Seeding on these dates has also given the best results for the whole 4 years of the test. Winter barley has not proven a reliable crop at the station.

Peas (pp. 126–130, 148).—Fifty-two varieties were tested, 41 of which have been grown on the experimental grounds 5 years in succession. The data for the yields of grain and straw and percentage of grain injured by weevils are tabulated. The best yields in 1898 were given by Waterloo, Early Fame, White Wonder, and Tall White Marrowfat, in the order named, each yielding over 30 bu. per acre. White Wonder stands at the head of the varieties tested for 8 years, having an average grain yield of more than 37 bu. per acre. This variety is considered especially desirable for comparatively rich soils because of its short growth of straw. The Odd Fellow and Mummy varieties have been least subject to weevil attacks. Peas were sown broadcast and in drills on 6 different dates. The best results in 1898 and the best average results for 3 years were obtained from plats sown about April 22 with a drill.

Spring wheat (pp. 130–132, 148).—Data for tests of 48 varieties are recorded. The average yield for all varieties was 32 bu. per acre. The largest yield, 48.29 bu. per acre, was afforded by Wild Goose, followed by Medeah, 42.55 bu., and Herison Bearded, 41.07 bu. per acre. Wild Goose has given the best average yield of 15 varieties tested for 9 years or more—34.13 bu. per acre. Red Fern stood second with an average yield for the same period of 30 bu. per acre. Herison Bearded is considered one of the best milling varieties tested; its average yield for 10 years has been 28 bu. per acre, with an average weight of 62.5 lbs. per bushel. The average difference in yield of seeding wheat broadcast and with a drill has not varied more than 10 lbs. per acre in the 4 years in which this subject has been investigated. Early seeding, April 18–19, has given the best results for 6 different dates tested.

Winter wheat (pp. 132–136).—A summary is given of the data already published in College and Farm Bulletin 108 (E. S. R., 10, p. 63), and, in addition, comparative data showing the pressure required to crush the grain of 48 varieties grown in 1896 and 1898. "The 15 hardest wheats produced an average of 7.2 bu. per acre less than the average of the 15 best-yielding varieties, and 2.9 bu. per acre more than the average of the 15 poorest-yielding varieties." Pride of Genesee and Turkish Red were the hardest wheats tested, each being rated at 100. The first, however, stands 19 in average yield and the second 42 in a test of 48 varieties. As a rule, red wheats have proven harder than white wheats. The hardest varieties usually give low yields and possess light straw.

Oats (pp. 136–140, 142, 148).—Of 91 varieties tested in 1898, Vick American Banner, Poland White, Siberian, Joanette, Improved Besthorne, Holstein Prolific, Probsteier, and Oderbrucker stand at the head of the list, in the order named, with average yields of more than 106 bu. per acre. The Siberian is considered the best all round variety tested, its average grain yield for 10 years having been 82.69 bu. per acre. Joanette has given the best average yields of the black oats, and in cooperative tests on 108 Ontario farms it exceeded Black Tartarian by about 2 bu. per acre. Eleven of the varieties tested in 1898 produced grain averaging upwards of 40 lbs. per measured bushel. The percentage of hull to grain was least with the Joanette variety. Seven varieties produced grain having less than 30 per cent of hull. Oats drilled have given better results for 3 years in succession than oats seeded broadcast, and the best yields and heaviest oats per measured bushel have been obtained from seeding on or about April 22. "After this date there was considerable decrease in quantity and quality of grain." Winter oats have not been successfully grown.

Rye (pp. 140–141).—Three varieties each of spring and winter rye were tested. Dakota Mammoth and Prolific Spring gave the best yields of the spring varieties, each over 35 bu. per acre, and Mammoth Winter and Monster Winter the best of the winter varieties, each yielding more than 57 bu. per acre.

Beans (pp. 142–144).—Thirty-seven varieties were tested. White Wonder has given the best average yield for 2 years in succession, 27.46 bu. per acre. Schofield Pea, Burlingame Medium, Pearce

Improved Tree, and Medium or Navy have given average yields for the same period of from 24 to 25 bu. per acre. The best average yields of varieties tested for 5 years have been made by Medium or Navy, Boston Pea, and Small White Field, an average of a little more than 18 bu. per acre.

Mixed grain (pp. 144, 145).—Eleven combinations of oats, spring wheat, barley, and peas have been tested for 6 years for the production of grain and straw. The best yield of straw in 1898 was obtained from a mixture of peas and oats and the heaviest yield of grain from a mixture of barley and oats. Barley and oats, and barley, peas, and oats have given the heaviest yields of grain for the whole period of the test. The influence exerted by the different grains on the yield of grain is in the following order: Oats, barley, peas, and wheat.

Seed selection (pp. 144–148).—Different qualities of seeds for a number of crops were selected and tested. Large plump seed have given the largest yields and heaviest grain per measured bushel for barley, spring wheat, oats, and peas. Hulled oats gave better yields than light-weight oats. Whole peas gave yields 3 times greater than cracked peas, and in a test of weevily peas only about one-fourth of the infected seeds grew.

Preparation of soil (pp. 149, 150).—Spring grain on potato, turnip, or carrot land gave the best yields on that portion of the plats which were plowed. The quality of the grain, however, was somewhat better on the portion simply cultivated.

Potatoes (pp. 150–159).—The results for 1898 and the average results for 3 years are tabulated for 183 varieties of potatoes. Convoy, Empire State, and Rural New Yorker have produced the largest average yields for this period, all having yielded at the rate of more than 220 bu. per acre. Ninety-one per cent of the crop of Rural New Yorker No. 2, Ohio Jr., Green Mountain, and Boley Northern Spy were marketable. Empire State has given the largest average yield of 39 varieties tested for 7 years in succession, and is considered one of the most substantial varieties grown. In a 3-year test of 11 early varieties, equal portions of which were harvested 9, 12, and 15 weeks after date of seeding, Stray Beauty gave the largest average yield at the first digging, 124 bu. per acre, followed by Early Ohio, 111.98 bu., and Howe Premium, 107.92 bu. per acre. The largest yields for 4 years in succession have been obtained from planting large seed, and this has been true whether whole seed potatoes were being compared or single eye pieces of different sizes. In a test of single pieces weighing 1 oz. each and containing different numbers of eyes, the best yield was obtained from the pieces having the largest number of eyes. Potatoes planted in rows 26.4 in. apart and 12 in. distant in the row and given flat cultivation gave better yields than potatoes planted in rows 33 in. apart and 33 in. distant in the row and cultivated either flat or hilled. Potatoes cut and planted the same day have given better yields for 4 years in succession than when planted 4 days after being cut.

Mangels (pp. 159, 160).—Jarman Selected Golden Tankard and Jarman Giant Intermediate gave the best yields in 1898 in a test of 67 varieties of mangels, the yield in each case being at the rate of more than 34 tons per acre. Among 27 varieties tested for 8 years Evans Improved Mammoth Saw Log, Simmer Improved Mammoth Long Red, Steele Long Red Selected, and Carter Champion Yellow Intermediate have given the best results, with yields in each instance averaging more than 23 tons per acre.

Sugar beets (p. 161).—Fourteen varieties of sugar beets were grown for feeding purposes. Lane Improved gave the largest yield in 1898. It has also given the best average yields of 8 varieties tested for 7 years in succession, a little more than 19 tons per acre. Of the varieties tested for a less number of years Green Top White and New Danish Improved, each with yields upward of 20 tons per acre, stand at the head.

Carrots (pp. 162, 163).—The best yields in 21 varieties tested for 7 years have been made by Pierce Improved Half Long, 29.1 tons per acre; Mastodon, 28.44 tons per acre, and Steele Improved Short, 28.41 tons per acre. In all, tests of 51 varieties are reported, but these average yields have in no instance been exceeded.

Kohl-rabi (pp. 163, 164).—Early White Vienna gave the best yield in 6 varieties tested in 1898, 23.95 tons per acre. The largest average yield for 2 years has been made by Large White, 25.70 tons per acre, and Early White Vienna, 25.45 tons per acre.

Fall turnips (pp. 164, 165).—A special feature of this test was the determination of the rot-resisting quality of 46 varieties. Varieties least subject to rot were Cow Horn, Yellowstone, Early American, Purple Top, White Egg, Jersey Navet, and Jersey Lily, in the order named.

Root seeding and culture (pp. 165–169).—Seeding mangels, carrots, sugar beets, and Swedish turnips 1 in. deep has given better results in every instance than seeding 2, 3, and 4 in. deep; and large plump seed has given better yields than medium sized or small seed. Thinning when the plants were 1½ to 2 in. high has been found a better practice than waiting until the plants have attained a height of 8 to 10 in. The average yields from flat culture have been slightly in excess of the yields obtained when ridge culture was practiced; and nitrate of soda has proven a more efficient fertilizer for roots than muriate of potash, superphosphate, or a complete fertilizer.

Millet (169, 170).—Japanese millet (*Panicum miliaceum*) with a hay crop of 5.89 tons has given the highest average yield of 19 varieties, 14 of which have been tested for 4 years in succession. The largest average yields of seed per acre were produced by Hungarian Grass, California, Siberian, and Early Harvest.

Besides these crops data are also given of tests of 12 varieties of pumpkins and squashes, 3 of sunflowers, 2 of rape, 20 of grasses, 11 grain mixtures for green fodder, 2 grass mixtures for permanent meadows, 6 pea and bean fodder crops, and a few varieties each of kale, cow cabbage, clovers, and other miscellaneous crops. Nitrate of soda has proven the most efficient fertilizer for rape. Subsoiling for this crop has not proven financially profitable. Rape seeds planted from ½ to 1 in. deep produced a greater percentage of plants than when planted deeper.

Cooperative experiments in agriculture, C. A. ZAVITZ (*Ont. Agr. and Expt. Union Rpt. 1898, pp. 14–42*).—This report presents the summarized results of successful experiments made in 1898 and the conclusions drawn from them. Nineteen different experiments, representing nearly all the farm crops grown in Ontario, were conducted by 3,028 farmers, 667 of whom sent in satisfactory reports.

In the fertilizer tests, nitrate of soda and muriate of potash were each applied at the rate of 160 lbs. per acre, and superphosphate at the rate of 320 lbs. The complete fertilizer consisted of 53⅓ lbs. each of nitrate of soda and muriate of potash and 106⅔ lbs. of superphosphate per acre. As in the preceding season, a complete fertilizer proved best for oats, a potash fertilizer for corn, and a nitrogenous fertilizer for mangel-wurzels. The largest average increase in yield per acre attributed to the use of fertilizers was 9.8 bu. for oats, 1.32 tons for corn, and 5.74 tons for mangel-wurzels.

The results of a test of various crops for green fodder showed that grass peas were more productive and better suited for this purpose than crimson clover or vetch. One and one-half bushels of oats and 1 bu. of peas per acre are recommended as a good mixture for the production of green fodder. Among 4 varieties of millet Japanese panicle and Japanese common were the most popular with the experimenters. Four different grasses—tall oat grass, timothy, meadow fescue, and orchard grass, and 4 leguminous crops—mammoth red, common red, and alsike clover, and alfalfa, each mentioned in the order of their productiveness, were tested as hay crops. Of the varieties of buckwheat tested, Japanese, stood first; Silver Hull, second; and Common Grey, third. Spring rye gave a larger yield than either of 3 varieties of spring wheat with which it was compared. Of these varieties of wheat Rio Grande, which has a rather coarse grain, was most productive. Mandscheuri barley has maintained its place at the head of the list of varieties tested for 7 years in succession. The results show that six-rowed varieties of barley are more productive than either the two-rowed or hulless sort. In the comparative tests of oats, Siberian stood first for 4 years; then in 1896 and 1897, Oderbrucker gave the best yield; and in 1898, Siberian again took the lead.

Of 4 leading varieties of peas, Early Briton, the best yielder for 3 years, and Chancellor, were considered the best varieties by the experimenters in 1898. The White Wonder bean was found more productive than the California pea bean. Evans Improved Mammoth Saw Log mangel-wurzel has given the highest average yield per acre, 35.1 tons, among the varieties grown for 3 years. Fall turnips gave larger yields than swedes. Purple Top Mammoth turnips and Hartley Bronze Top swedes are considered the best among the varieties tested. No one variety of corn was found well suited to the entire Province. Mastodon Dent corn produced the largest yield of fodder per acre and appeared to be well suited to southern Ontario; while Mammoth Cuban gave best results in the central and southern parts, Wisconsin Earliest White Dent in the central, and Salzer North Dakota in the northern part. Of the 6 varieties of potatoes used in the test in 1898, American Wonder was the latest and most productive and Stray Beauty the earliest and least productive. The varieties of winter wheat tested, given in the order of their productiveness for the season, were Dawson Golden Chaff, Imperial Amber, Early Genesee Giant, New Columbia, Early Red Clawson, Pride of Genesee, and Poole. Dawson Golden Chaff has been the most highly prized by the experimenters for the past 5 years.

The relation between grain weight and percentage nitrogen content of barley, W. JOHANNSEN (*Chem. Ztg.*, *23* (*1899*), *No. 74*, *p. 275*).—Great variation was found by the author in the nitrogen content of fully developed ripe barley grains from different heads of the same variety of barley grown under like conditions. No definite law relative to this variation was found, but in general the nitrogen content increased with the weight of the kernels. By careful selection, however, for 4 years, a strain of barley was obtained which yielded heavy grains low in nitrogen content.

Improvement in the chemical composition of the corn kernel, C. G. HOPKINS (*Illinois Sta. Bul. 55*, *pp. 205–240*, *figs. 5*).—A report by the station on the chemistry of the corn kernel has been previously noted (E. S. R., 10, p. 844). In the present work the details and results of extensive experiments made to determine the influence of selection in increasing or diminishing the protein and fat content, respectively, of the kernel are given; together with other data on the selection of corn with reference to protein and fat content on the basis of mechanical analysis, and on the proportion of corn germ to kernel.

On the basis of analyses 4 sets of ears were selected for experiment from the 1896 crop of Burr White corn: "(1) A set of 24 ears whose percentage of protein was comparatively high; (2) a set of 12 ears each of which contained a low percentage of protein; (3) a set of 24 ears high in fat content; and (4) a set of 12 ears low in fat content." Each set of ears was planted on separate plats in the spring of 1897. The ears showing the characteristics sought in the highest degree were planted in the middle rows of the plats. At harvest time 10 good ears were selected from each row, except in some instances the outer rows, in each of the 4 plats. From these a composite sample was made by shelling 2 rows lengthwise from each of the 10 ears and mixing the kernels. The average protein or fat content of each row was found by analyzing this composite sample.

Seed for the 1898 crop was obtained by selecting the 4 best ears in each set of 10 ears of the 1897 harvest. These were analyzed individually and the ears again showing the characteristics sought in the highest degree were used for seed. Only seed grown on the "high protein" plat of 1897 was used for planting the "high protein" plat of 1898. Similarly, only seed selected from corn grown on the "low protein" plat was used for replanting this plat the following season, and the same principle was observed in replanting the "high fat" and "low fat" plats. This was for the purpose of retaining the hereditary characteristics of the seed. In 1898, 2 additional plats, arranged to overcome local differences in soil conditions, were added to those already noted. Each plat consisted of 5 rows of 10 hills each. Four kernels of corn were planted in each hill. On the protein plat these consisted of 2 kernels high in protein and 2 low in protein; and on the fat plat, 2 kernels high in fat and 2 low in fat content. The kernels were so placed that the stalk of corn grown from each seed could be known. The crops were gathered and analyzed as in the other plats.

Tables showing the composition of corn planted and of the crop harvested are given for each of the plats, and also the analyses of a large number of individual ears from the different plats showing variations from the corn planted, and these data are discussed at length. A summary is given in the following table:

Composition of corn planted and harvested in 1897 and 1898.

	Crop of 1897.		Crop of 1898.		Crop of 1898 (mixed plats).	
	Planted.	Harvested.	Planted.	Harvested.	Planted.	Harvested.
Protein:	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
High protein plat	12.54	11.10	12.49	11.05	12.60	11.71
Middle rows	12.84	11.12	12.87	11.17	....	....
Low protein plat	9.03	10.55	9.06	10.55	8.66	10.46
Middle rows	8.79	10.21	8.70	10.46	....	....
Fat:						
High fat plat	5.33	4.73	5.20	5.15	5.45	5.08
Middle rows	5.52	4.80	5.38	5.29	....	....
Low fat plat	4.04	4.06	3.65	3.99	3.47	3.97
Middle rows	3.99	4.03	3.49	3.85	....	....

> "In the 6 tests the selection of seed corn of high and low protein content has produced differences in the crops varying from 0.50 to 1.25 per cent of protein . . . The selection of seed of high and low fat content has produced differences in the crops varying from 0.67 to 1.45 per cent of fat. The fat content of corn is even more susceptible to the influence of seed selection than is the protein content, doubtless due to the fact that the primary materials from which fat is manufactured, namely, carbon dioxid and water, are usually furnished to the plant in unlimited supply, while the formation of protein is essentially dependent upon the supply of available nitrogen in the soil."

On the basis of a knowledge of the general structure of the corn kernel and the chemical composition of its several parts, the author made investigations to determine the possibility of selecting corn of high or low protein or fat content by purely mechanical means. Longitudinal and cross sections of the kernels were made and the corn classified with reference to protein on the basis of the development of the glutinous layer and with reference to fat content on the basis of the germ development of the kernel. A large number of ears high in protein were mixed with ears low in protein. These were afterwards separated by mechanical means. To test the accuracy of the results, the ears were also analyzed. But few errors in the mechanical separation were made. The method of mechanical analysis was found even more satisfactory when applied to the detection of ears high or low in fat content as shown by the development of the seed germ. The results obtained in the several tests lead to the belief that mechanical analysis of corn kernels with reference to protein or fat content is "both possible and practical."

The question whether the size of the corn kernel bears any special relation to the percentage of protein or fat which it contains was investigated. The weight of kernels from 24 different ears high in protein varied from 0.29 to 0.47 gm. and averaged 0.372 gm. per kernel. The weight of kernels from 16 different ears low in protein varied from 0.275 to 0.41 gm. and averaged 0.337 gm. per kernel. The average weight of kernels from 12 ears of corn high in fat content was 0.345 gm. per kernel and the average weight of kernels from 16 ears of corn low in fat content, 0.42 gm. per kernel. In general, the tendency of corn high in fat content was toward small kernels, and *vice versa*.

To obtain exact data as to the relation between percentage of fat and percentage of germ in the corn kernel, the germs from 80 kernels were removed by soaking in hot water for about 30 minutes. The weight of the whole kernel and also of the separate germs were determined and the results are reported on the basis of dry matter. A synopsis of this data is given in the following table:

Relation of corn germ to kernel.

High in fat				Low in fat.			
Average fat content.	Average weight of kernel	Average weight of germ.	Percentage of germ to kernel.	Average fat content.	Average weight of kernel.	Average weight of germ.	Percentage of germ to kernel.
Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
6.49	0.2652	0.0374	14.11	3.58	0.4631	0.0421	9.10
6.71	.3013	.0373	12.40	3.22	.3181	.0272	8.56
6.08	.3105	.0373	12.01	3.64	.2877	.0238	8.28
5.82	.3419	.0453	13.30	3.32	.3502	.0307	8.73
6.28	.3047	.0394	12.96	3.44	.3548	.309	8.47

"It will be seen that the general relation between the percentage of fat and the percentage of germ in the corn kernel is clearly established."

In conclusion the author states that—

> "All results thus far obtained indicate that it is possible to influence the composition of corn; that by proper selection of seed any of its principal constituents, protein, fat, or carbohydrates, may be increased or decreased. . . .

"While further investigations are necessary and are in progress to determine more accurately the best methods and more definitely the possibilities of improvement in the chemical composition of corn, it is here stated tentatively that . . . any corn grower will be able to select seed and to breed corn to increase or decrease the percentage of any one of its 3 principal chemical constituents. . . .

"It may be stated that improvement in the composition of other parts of the corn plant is under consideration by this station. Plans are made also to investigate other questions relating to this general subject; such as the effect of changes in the chemical composition of corn upon its digestibility, vitality, yield, etc."

Composition of rye grain at different stages of ripeness, N. K. NEDOKUCHAEV (*Izv. Moscow Selsk. Khoz. Inst., 5, (1899), pt. 2, pp. 212-224*).—The composition of rye grains was investigated at 5-day intervals, beginning with the close of the period of flowering and ending with the stage called yellow ripeness. It was found that there was an accumulation of carbohydrates, the soluble forms being transformed into insoluble ones. Proteids accumulated at the expense of other nitrogenous compounds, the latter compounds decreasing in amount with the processes of ripening. The relative amount of asparagin nitrogen compared with the total nitrogen remained constant.—P. FIREMAN.

Australian saltbushes: Results of 18 years' tests—characteristics, propagation, and field experiments; composition and food value, C. H. SHINN and M. E. JAFFA (*California Sta. Bul. 125, pp. 30, pls. 7*).—An account is given of the introduction and increasing culture throughout the State of the different species of saltbushes, more especially *Atriplex semibaccata*, brought into California from Australia; of the tolerance of these plants for dry alkali soils, and of their growth on nonalkali uplands; of their vegetation characteristics, and of the cultural methods practiced in California; together with notes on saltbushes in other countries, and descriptions of some 15 species of Atriplex and of the Pacific Coast Salsolaceæ. Results of seed germination tests, and data as to the composition and fodder value of saltbushes are included in the bulletin.

At the Paso Robles Substation seed of *A. semibaccata*, sown in December on poor arid soil, underlaid by hardpan, gave the following season a production of hay equal to 5½ tons per acre at the first cutting in September. Only 4.25 in. of rain fell during the season. Three cuttings were practicable. The same season and with about the same rainfall the yield of green forage on heavy, dark, nonalkali soil, containing considerable adobe, was at the rate of 30 tons per acre. The plant withstood a temperature of 14° F.

"On land of which the surface foot contains 0.3 per cent of salt the young plant was found to come up easily, but suffered when the salt contents reached nearly 0.8 per cent, or about 31,000 lbs. of salts to the upper acre-foot. Some of the older plants lived well in soils having a total of 92,000 lbs. per acre in a depth of 3 ft., of which 23,000 lbs. was 'black alkali.' Where the surface crust or upper half inch contained 8 per cent of salts the young plants barely kept alive, and when the amount of salts near the surface was 25 per cent they perished. Nevertheless, there are cases at the Tulare Substation, where single plants, under favoring circumstances, obtain root and thrive where the amount of alkali approaches these highest limits."

As to the desirability of the plant for stock feeding, 5 farmers report that stock will not eat it; 8 that stock will eat only a little, and 37 that stock thrive upon it and are very fond of it. *A. semibaccata* is considered the most desirable of the varieties thus far tested in California, both as regards quantity of yield and quality of crop. It is an arid plant and can not endure heavy summer rains or a moist warm climate.

The root system of *A. semibaccata* grown on alkali and nonalkali soils was studied. On dry alkali soils where water was less than 25 ft. from the surface, the roots did not exceed 5 ft. in length and were branched and fibrous. But one main root developed on plants grown on nonalkali upland soil. This was capable of penetrating through hardpan from 2 to 3 ft. thick. The water content to a depth of 6 ft. of different soils on which the saltbush grew was 394 tons per acre on sandy soil, 1,440 on strong alkali soil, and 690 tons on hardpan soil.

Seeding in place is considered preferable to transplanting. On alkali soils the seed is sown early in October on the surface of the soil and firmed but not covered; on arid uplands a slight covering is desirable. In a germination test of covering the seed on nonalkali soil $\frac{1}{8}$, $\frac{1}{4}$, $\frac{3}{8}$, and $\frac{1}{2}$ in. deep, and not covering, the best results, 70 per cent of healthy plants, were secured when the seed was covered $\frac{1}{8}$ in. deep. At a depth of $\frac{1}{2}$ in. only 25 per cent germinated. Unirrigated alkali soils in a region of light rainfall are thought best for producing market seed.

Methods of feeding saltbushes with other fodders and in silage mixtures are suggested. The food value of different species of this plant is shown by analysis to be as follows:

Composition of different saltbushes.

Name and locality.	Moisture.	Pure ash.	Crude protein	Crude fiber	Nitrogen-free extract	Crude fat.
GREEN.						
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
A. semibaccata, Tulare, Cal	78.03	4.58	2.75	3.75	10.41	0.48
A. semibaccata, Paso Robles, Cal	75.00	4.93	3.93	5.58	10.15	.41
A. campanulata, Australia	75.00	5.98	3.06	4.53	10.87	.56
A. nummularia, Australia	75.00	7.82	4.11	1.81	10.71	.55
Average	75.76	5.83	3.46	3.92	10.53	.50
HAYS.						
A. semibaccata, Tulare, Cal	7.05	19.37	11.64	15.88	44.05	2.01
A. semibaccata, Paso Robles, Cal	10.00	17.74	14.14	20.18	36.54	1.47
A. campanulata, Australia	10.00	21.53	11.01	16.30	39.13	2.01
A. nummularia, Australia	10.00	28.15	14.79	6.51	38.55	1.98
Average	9.02	21.70	12.89	14.72	39.57	1.87

The fertilizing value of the saltbushes and their value in reducing the alkali constituents of the soil to within the limits of toleration for some other crops are noted, the discussion being based on the following ash analyses:

Analyses of ash of different saltbushes.

	Grown in Australia.		Grown in California.	
			A. semibaccata.	
	A. campanulata.	*A nummularia.*	Tulare.	Paso Robles.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*
Silica	[a] 2.27	[a] 1.12	16.24	......
Potassium oxid	13.61	15.69	11.42	......
Sodium oxid	47.80	45.44	35.39	......
Calcium oxid	8.47	8.65	5.79	......
Magnesium oxid	5 82	6.77	3.23	......
Peroxid of iron	1.83	.64	1.38	......
Alumina			1.95	......
Manganese sesquioxid	......	......	.22	......
Phosphoric acid	3.80	4.11	2.80	......
Sulphuric acid	2.62	3.17	2.64	......
Chlorin	21.56	18.47	24.33	24.03
Total	107.78	104.06	105.35	......
Excess of oxygen due to chlorin	7.78	4.06	5.35	......
	100.00	100.00	100 00	......
Common salt in ash	35.36	30.28	39.90	39.39
Common salt in fresh plant	2.11	2.37	1.83	1.94
Common salt in air-dried plant	7.61	8.52	7.73	7.48

[a] Soluble silica

Change in the sugar content of beets stored in warm and cold rooms (*Bl. Zuckerrübenbau, 6 (1899), No. 20, pp. 316, 317; Deut. Landw. Presse, 26 (1899), No. 81, p. 926*).—Experiments were made by B. Schulze at the Breslau experiment and control station to determine the increase in sugar content of sugar beets caused by evaporation in cold and warm storage. Whole sugar beets in cold storage changed scarcely at all in sugar content during a period of 10 days. In warm storage, however, the sugar content had increased 0.6 per cent at the end of 7 days and at the end of 10 days had risen to 1 per cent. In the case of beets cut in half and one-half stored in a cellar having a temperature of 6 to 7° C., and the other half in a heated room having a temperature of from 18 to 20° C., the percentage of sugar in the halves stored in the cellar increased 0.2 per cent in 2 days and 1.3 per cent in 5 days. The percentage in the halves stored in the warm room increased 0.2 in the first 24 hours, 0.8 in 3 days, and 1.7 in 5 days. In another similar series of experiments the half beet stored in the cellar maintained a constant sugar content for 4 days. On the fifth day the percentage had increased 0.5. The half stored in the heated room had increased 0.3 per cent at the end of 2 days and at the end of 5 days 1.1 per cent.

Wheat—varieties, breeding, cultivation, W. M. Hays and A. Boss (*Minnesota Sta. Bul. 62, pp. 321–494, figs. 51, charts 1*).—This bulletin contains a history, with detailed records, of variety, selection, and breeding experiments carried on by the station and substations through a series of years; a discussion of the botanical characteristics of wheat and of the methods employed by the station in breeding wheat; and suggestions regarding field management of wheat in rotations.

Since the beginning of the experiments with wheat by the station in 1888, 552 foreign and home varieties have been tested. Forty-nine of these varieties have been originated at the station, 6 of which were cross-bred wheats. A large number of the varieties tested were soon discarded because of poor yields of grain or grain of inferior quality. About 200 varieties, collected previous to 1894, have been grown in cooperation with the North Dakota Station. In 1897 these had been culled out to 8 varieties, and in order to still better decide between these varieties a small amount of the grain of each was milled and the flour subjected to the color test, gluten test, and bakers' sponge test. As a result of these tests only 4 varieties were retained in 1898 for further experimentation at the Minnesota Station. These were Bolton Blue Stem, Haynes Blue Stem, Power Fife, and Glyndon No. 711, with average yields for 8 seasons of 24 2, 20.6, 20.8, and 20.8 bu. per acre, respectively.

The color test, gluten test, and bakers' sponge test are described in detail, and tables given which show the average yield of wheat per acre, grade, rust resistance, bakers' sponge test, and gluten test of the best 8 out of 200 varieties collected previous to 1894, and of the best Russian and Saunders cross-bred wheats collected from 1893 to 1896. None of the Russian wheats were found equal to Minnesota wheats, and but one of Saunders cross bred wheats has been retained, the variety Preston, which has given an average yield for 3 years of 23.1 bu. per acre.

Fife and Blue Stem varieties of wheat have been found best suited to Minnesota conditions. Six of the best of each of these varieties were compared with each other and with 3 of the best new varieties originated by the station by selection. The average yield for 2 seasons of the Fife varieties was 22 bu., Blue Stem varieties 23.3 bu., and the new varieties 23.6 bu. per acre.

In a comparison of 8 of the best of 31 varieties improved by selection with 4 of the best collected varieties, the average yield for 4 years for the improved varieties was 26.6 bu., and of the collected varieties 23.6 bu. per acre. Two of these varieties, Minnesota No. 169, obtained by selection from Haynes Blue Stem, and Minnesota No. 163, obtained from Glyndon No. 811 in the same manner, have given average yields for 4 years of 28.4 and 27.7 bu. per acre, respectively.

In 1892 some of the best varieties of wheats were crossed either with pollen from different plants of the same variety or from different varieties. The seed resulting from these crosses was sown, the best plants selected, and the seed from these again sown. This process was repeated with a limited number of the best plants until 1897, when twenty-acre plats were grown. The average yield of 3 varieties obtained by crossing different plants of the same variety for 1897 and 1898 was 21.5 bu., and of 3 varieties obtained by crossing different varieties 21.1 bu. per acre.

The best seed wheats are distributed by the station throughout the State to a few of the better farmers in each county who practice rotatation, and to seedsmen. A price for the wheat is charged and a certificate showing the history of the wheat at the station given.

Following the classification of wheat adapted from Haeckel's "The True Grasses," and general remarks on the botany of wheat, some results are given with drawings of investigations on the root and stem development of wheat, and on the opening of the flowers and anthers. The wheat flowers were found to open early in the morning. The different stages in the unfolding and closing of the flowers are shown in a series of 10 sketches in the case of a blossom which commenced unfolding at 4.45 a. m. and closed at 5.18 a. m.

The method of breeding wheat employed by the station is discussed at length. Charts showing the variation in height of plant, grade of grain, etc., in newly bred wheats are added and details given of planting, selecting, harvesting, and keeping notes. Plans for a wheat crop in six-year and three-year rotations are shown by the aid of diagrams, and suggestions given for the field culture of wheat.

The manuring of potatoes (*Jour. Bd. Agr.* [*London*], *6* (*1899*), *No. 2, pp. 169–172*).—Results are reported of experiments made at different agricultural colleges in Great Britain to determine the effect on the crop of varying quantities of commercial fertilizers, used alone or in combination with barnyard manure. Plats were fertilized with 4, 8, and 12 cwt., respectively, of complete fertilizers (composition not given) combined with 9 tons of barnyard manure in each instance. The increase in the yield of potatoes from this treatment was not in proportion to the increase in the commercial fertilizers applied, and the experiment was financially unprofitable when more than 400 cwt. of commercial fertilizer per acre was employed. Similarly in another experiment a dressing of 10 tons of barnyard manure per acre gave a large increase in yield of potatoes over unmanured plats, but increasing the amount of barnyard manure or fertilizer did not give a proportionally greater profitable yield.

A test was made of the partial substitution of commercial fertilizers for barnyard manure in growing potatoes. Certain plats received 20 and 10 tons of barnyard manure per acre, respectively, while a third plat received 10 tons of barnyard manure and 625 lbs. of a complete commercial fertilizer. The yields of potatoes on the third plat were greater than on the plats fertilized with 10 tons of barnyard manure alone, but not quite so good as yields on the plat receiving 20 tons. The experiment is held to show "that properly proportioned dressings of artificial manures are capable of forming perfectly adequate and effective substitutes for 10 tons of barnyard manure, and that greater profit can be made by growing potatoes with such artificials combined with a moderate amount of dung than by applying large quantities of barnyard manure alone."

In other experiments, in which one of the three essential ingredients was regularly omitted from the commercial fertilizers used in connection with barnyard manure on potatoes, the greatest diminution of crop occurred with the omission of the potash, and of the different forms of potash the poorest results were obtained with kainit and the best with muriate of potash.

Manuring of pastures (*Jour. Bd. Agr.* [*London*], *6* (*1899*), *No. 2, pp. 208–210*).—In experiments on the use of different fertilizers on meadows in 4 counties of England, the best results with regard to both bulk and quality were obtained with the use of phosphatic manures, and basic slag has proved the most suitable form. With this fertilizer good results were obtained 5 years after its application. On chalk and calcareous soils, however, superphosphate was quicker in its action and thought to be more economical than basic slag. Potash manures were especially valuable on light soils. They "greatly improved the quality of the herbage and developed leguminous plants." Nitrogenous manures, such as nitrate of soda and sulphate of ammonia, while increasing the weight of the crop the first year tended to make the pasture coarser, and this was true whether the pastures were grazed or mown. Common salt usually gave negative results, and the general belief that its use makes pastures finer was not supported in these tests. Lime gave good results in but few instances. Basic slag gave all the results usually attributed to lime and at much less cost. Barnyard manure was found most beneficial on light soils. Phosphatic and potash manures both are advised to be used with barnyard manures in order to counteract the tendency of the latter to produce a coarse herbage. The best time of application of phosphatic and potash manures for either hay or pasture land is thought to be in the autumn or early winter when it should be thoroughly harrowed into the soil. "This harrowing enables the manures to become effective more quickly and at the same time promotes the growth of finer herbage by removing the coarse fogg [aftermath] which is apt to accumulate on the surface of most pastures."

Quantities of nitrogen for grass, H. J. WHEELER and J. A. TILLINGHAST (*Rhode Island Sta. Bul. 57, pp. 13–17*).—Three permanent experimental plats which had been devoted chiefly to the growth of leguminous crops and which had received annual applications of muriate of potash and acid phosphate (13 to 14 per cent of available phosphoric acid) at the rate of 180 and 1,200 lbs. respectively, since 1893, were seeded in 1897 with a mixture composed of 7.5 lbs. of common red clover, 15 lbs. of timothy (*Phleum pratense*), and 7.5 lbs. of redtop (*Agrostis vulgaris*). All the plats were limed the same season with air-slaked lime at the rate of 1 ton per acre. One plat had received no nitrogen for 15 to 20 years; another had received annually from 1893 to 1899 150 lbs. of nitrate of soda per acre, and a third 450 lbs. of nitrate of soda per acre for the same period. The yield of hay on these plats in 1899, cost of the fertilizers applied, estimated valuation of the crop, and resulting profits are tabulated for each plat and the different phases of the experiment discussed.

The total yield from the plat which had received no nitrogen fertilizer was at the rate of 5,075 lbs. of hay per acre, made up almost entirely of clover. The total yield of the plat which had received 150 lbs. of nitrate of soda per acre yearly was at the rate of 6,300 lbs. of hay per acre. The first cutting from this plat consisted of about ⅓ clover and ⅔ timothy and redtop; the second cutting was ¾ clover. On the plat which had received nitrate of soda at the rate of 450 lbs. per acre the total yield was 6,913 lbs. of hay. Of this amount "nearly all of the first crop and about ¾ of the second one consisted of redtop and timothy hay."

The data show that the addition of the nitrate of soda, while of no special benefit to clover, greatly aided the growth of timothy and redtop, and is for these crops a valuable fertilizer.

Estimating the value of the manures at $42 per ton for muriate of potash, $40 for nitrate of soda, and $14 for acid phosphate, the profits from the different plats were as follows: First plat, no nitrogen, $6.09; second plat, 150 lbs. of nitrate of soda per acre, $14.34, and the third plat, 450 lbs. nitrate of soda per acre, $19.62.

Financial gain from liming grass land, H. J. WHEELER and J. A. TILLINGHAST (*Rhode Island Sta. Bul. 58, pp. 21–26, fig. 1*).—Data are given for the yields of grass grown for 4 years in succession on limed and unlimed plats which had received the same amounts each year of nitrate of soda and muriate of potash. The same money worth of different forms of phosphoric acid had been used on the different plats in the beginning of the experiment, but owing to great variations in price this was later changed so that in 1899 the crop on each plat had received practically the same amount of phosphoric acid. The limed plats received but one application of lime. This was applied at the rate of 1 ton per acre in 1894. Corn was grown in both series of plats in 1894 and oats in 1895. The use of the lime increased the yield of corn stover on every plat and also the yield of grain, except on plats which had received raw alumina phosphates or floats. The oat crop in 1895 lodged badly, and the data are given merely as a matter of historical completeness. The grass crops of 1896 to 1899 were most benefited by the application of lime. In general, the plats receiving superphosphates were more benefited by lime than those receiving unacidulated forms of phosphate of lime. The author estimates the financial value of the increase of the limed over the unlimed plats to be from $27.09 on the plat fertilized with basic slag meal to $62.35 on the plat which had received ignited alumina phosphate, while the average financial gain for all the limed plats was $45.10. The limed plat which had received no phosphoric acid whatever gave a financial profit second only to the plat fertilized with ignited alumina phosphate, $55.81 per acre.

Report of the farm superintendent, W. M. RENNIE (*Ontario Agr. Col. and Expt. Farm Rpt. 1898, pp. 185–198*).—Report on general improvements made during the year with notes on wheat, oats, barley, peas, corn, and potatoes grown and on the preparation of the seed beds for grain and roots. A report on some feeding experiments is noted elsewhere in this issue (p. 672).

Investigations on the influence of cultivation on the productiveness of soils, E. WOLLNY (*Forsch. Agr. Phys. [Wollny], 20 (1898), No. 3, pp. 231-289*).

Cultivation of alfalfa, G. D'UTRA (*Bol. Inst. Agr. São Paulo, 10 (1899), No. 3, pp. 140-157*).

Experiments with lucern (*Deut. Landw. Presse, 26 (1899), No. 90, pp. 1017, 1018*).—Experiments with fertilizers were made on alfalfa grown for the fourth year on land which contained 0.32 per cent of potash in the upper soil and 0.098 per cent of potash in the subsoil. Thomas slag was used alone on one plat, Thomas slag combined with kainit on another, and Thomas slag, kainit, and gypsum on a third. Increased yields were secured in every instance, but the best and most profitable results were secured on the plat manured with all 3 fertilizers applied in the proportion of 600 kg. of Thomas slag, 1,000 kg. kainit, and 1,000 kg. of gypsum.

Concerning the means of growing barley for brewing of low nitrogen content on light soils, T. REMY (*Deut. Landw. Presse, 26 (1899), Nos. 91, pp. 1030, 1031; 92, pp. 1038, 1039*).—Discussion based on work by the author previously noted (E. S. R., 11, p. 531).

Analyses of barley of the 1899 harvest, A. LANG (*Ztschr. Gesam. Brauw., 22 (1899), p. 515; abs. in Chem. Ztg., 23 (1899), No. 82, Repert., p. 293*).—Analyses of samples from a number of different provinces.

Fertilizer experiment with barley, A. SCHILLING (*Ztschr. Landw. Ver. Hessen, 1899, No. 42, pp. 544, 545*).

Improvement in the chemical composition of the corn kernel, C. G. HOPKINS (*Jour. Amer. Chem. Soc., 21 (1899), No. 11, pp. 1039-1057, pls. 2*).—A shorter account of an investigation reported in Illinois Station Bul. 55 (see p. 633).

Cotton culture (*New York: German Kali Works, 1899, pp. 90, figs. 20*).—"The object of this handbook is to present, in convenient form, various details, facts, and reports of improved methods of growing cotton profitably." Methods of cotton culture, and the injurious diseases and insects affecting cotton are given. The appendix contains useful information on fertilizers.

The harmful effects of lime on lupines, ADLER (*Ber. Landw. Vers. Stat. Jena, 1898, pp. 20, 21*).—Different quantities of lime were added to 5 varieties of lupines grown in separate pots. Yellow lupine, black lupine, blue lupine (*Lupinus angustifolius*), and *Lupinus angustifolius leucospermus* all gave decreased yields in the limed pots, though not in proportion to the amount of lime applied. White lupine (*L. albus*) gave largely increased yields in the limed pots.

Study on the development of the sugar beet, L. GESCHWIND (*Bul. Assoc. Chim. Sucr. et Distill., 17 (1899), No. 3, pp. 217-236, figs. 11*).

Experiments with sugar beets, F. DESPREZ (*Jour. Agr. Prat., 1899, II, No. 49, p. 818*).—Data on the yield and sugar content of beets harvested at different dates. The best yields and largest sugar content were given by the harvests between October 21 and November 18.

Fertilizer experiments in Russia, F. LUBANSKI (*Bl. Zuckerrübenbau, 6 (1899), No. 22, pp. 343-347*).—Fertilizer experiments on sugar beets with nitrate of soda, superphosphate, kainit, lime, and the residue resulting from the final separation of sugar from molasses.

Record of experiments with some varieties of sugar cane imported into St. Croix from Hope gardens, Jamaica, C. DAHL and J. ARENDRUP (*Sugar, 12 (1899), No. 1, pp. 3-7*).—A test of varieties giving composition of juice and number of pounds of sugar produced per acre.

Seedling sugar canes, crop 1899 (*Bul. Roy. Bot. Gard. Trinidad, 1899, No. 21, pp. 221, 222*).—Analyses with reference to sugar content and percentage purity are given for 39 of the best canes grown in the 1899 crop. Nine canes contained more than 20 per cent of sucrose, 18 exceeded 19 per cent, and 13 exceeded 18 per cent. The endeavor to obtain a cane which will yield an average of 20 per cent of sucrose and thus maintain the supremacy of cane over the beet sugar industry is thought to be in a fair way of realization.

The daily root work of cane, A. DE VILLÈLE (*Rev. Agr. Réunion, 5 (1899), No. 9, pp. 399-410, dgms. 3*).—The composition of cane grown on fertilized and unfertilized soil was studied. The analyses of leaves, stalks, and roots were made at a number of periods intermediate between 21 and 245 days from date of planting and with especial reference to nitrogen, potash, and phosphoric acid absorption. The daily root work of the canes for different periods was found by dividing the amount of these elements absorbed by the number of days from date of planting.

Culture of sunflowers in Russia (*Mitt. Deut. Landw. Gesell., 14 (1899), No. 22, Sup., pp. 133-136*).

Light and heavy seeds for tobacco, TRABUT (*Gouv. Gen. Algeria, Serv. Bot. Bul. 17 (1898), pp. 4, figs. 3*).—Experiments by the author demonstrated that light tobacco seeds produced plants which developed slower, tended to flower before sufficient development had taken place, and produced a plant less green in color and weighing scarcely half that of plants grown from heavy seeds. He advises that tobacco seeds intended for planting be thrown into water and thoroughly agitated. The seeds which float should be thrown away and the remainder used for seeding the crop.

Virginia tobacco in São Paulo, G. D'UTRA (*Bol. Inst. Agr. São Paulo, 10 (1899), No. 3, pp. 121-130*).

Tobacco cultivation and curing, J. C. ESPIN (*Bul. Bot. Dept. Jamaica, n. ser., 6 (1899), No. 10, pp. 145-158*).—Article intended as a practical guide for all the different operations necessary in the culture, curing, and handling of tobacco as practiced in the West Indies.

Wheat lands of Canada, S. C. D. ROPER (*Pop. Sci. Mo., 55 (1899), No. 6. pp. 766-777*).

Growing wheat and flax together (*North Dakota Farm and Fireside, 2 (1899), No. 11, pp. 4, 5*).—The profitableness of growing these crops together as shown by actual yields is discussed.

How shall meadows be fertilized? J. KÖNIG and E. HASELHOFF (*Fühling's Landw. Ztg., 48 (1899), No. 22, pp. 841-848; Landw. Wchnschr. Prov. Saxony, 1 (1899), Nos. 33, pp. 385, 386; 34, pp. 397-399*).—Results of experiments with different fertilizers on moor, clay, lime, and sandy soils.

Experiments with commercial fertilizers on meadow lands, M. JANS (*Landw. Wchnbl. Schleswig-Holstein, 49 (1899), No. 48, pp. 887-889*).

A new method of ensiling, F. NOACK (*Bol. Inst. Agr. São Paulo, 10 (1899), No. 3, pp. 162, 163*).

HORTICULTURE.

Report of the horticulturist, H. L. HUTT (*Ontario Agr. Col. and Expt. Farm Rpt. 1898, pp. 93-108*).—Variety tests were made of red raspberries, black raspberries, blackberries, currants, gooseberries, strawberries, and tomatoes. In testing grapes "it has been found that varieties ripening with or later than the Concord do not mature a crop in more than one season out of four or five." The most desirable or promising among many varieties of geranium, coleus, gladioli, and chrysanthemum are mentioned.

A brief report is made on a forestry experiment conducted in cooperation with the Division of Forestry of this Department. Seeds of 9 species of forest trees were received from 14 States for experimental planting. The percentage of germination was poor owing probably to too great drying of the seeds before planting. A tabular statement is made of the height of the seedlings at the end of the first and second season's growth.

Forcing rhubarb, F. W. CARD (*Rhode Island Sta. Bul. 55, pp. 88–96, figs. 4*).—Six rhubarb plants taken from a lot which had been dug before the ground was frozen (December 6) were planted in the greenhouse, 3 in practically full sunlight and 3 in a warm place under the bench with sides and ends closed to keep them in darkness. On December 17 other plants were added to both groups from the remaining roots which had been left in the field and allowed to become thoroughly frozen. The plants were examined January 6. Those brought in before freezing had made but little growth, some of the plants in full sunlight being almost dormant. The frozen plants, however, were making rapid growth, especially those in the dark, where many vigorous stalks had started, some of which had attained a length of from 12 to 20 in. Of this growth the most was stalk, but little leaf being developed. The product from these stalks was delicately colored and of good flavor. The plants under the bench were removed February 27 and those above March 6.

On January 9, 5 large plants and 3 small ones which had been dug December 6 and left in the open field, subject "to repeated freezing and thawing, rain and snow," were placed in one corner of the cellar of a dwelling house and kept screened from the light. The cellar had an average temperature of about 40° F. and the soil was wet and muddy. At the same time similarly treated roots were placed under the greenhouse bench beside those put in earlier. Ten days later the plants under the greenhouse bench had started into good growth, many stalks being 3 to 4 in. long, while the roots in the dwelling-house cellar had remained practically dormant. These roots had only just pushed through the soil 3 weeks after date of planting and gave their first product March 11, or nearly 9 weeks from date of planting. The plants under the bench were removed March 17.

The total yield from the different lots and average yield per plant are shown in the following table:

Rhubarb forced in light and in darkness before and after freezing.

Condition of plants set.	Light.			Darkness.		
	Number of plants grown.	Total yield.	Average per plant.	Number of plants grown.	Total yield.	Average per plant.
		Pounds.	*Pounds.*		*Pounds.*	*Pounds.*
Not frozen	8	0.08	0.027	3	5.43	1.81
Frozen	9	41.06	4.56	7	43.47	6.21
Repeatedly frozen, grown in the greenhouse	....	....	....	8	41.34	5.17
Repeatedly frozen, grown in the cellar.	....	....	....	8	107.00	13.38

The yields are believed to show the value of allowing plants to freeze before attempting to force them and of growing them in darkness rather than in light.

The time required for the development of the different lots may be noted as follows: Unfrozen plants grown in light gave practically no yield at any time. Those grown in darkness yielded the bulk of their crop more than 2 months after being placed in position. Frozen plants grown in light gave their first large picking 8 weeks after being brought in and the second 2 weeks later, the bulk having been taken at these 2 times. Plants frozen and grown in darkness yielded several pounds 17 days after being brought in and the bulk within the next 2 weeks, but continued to yield something for a period of 6 weeks. Plants repeatedly frozen and grown in darkness in the greenhouse yielded 1 lb. per plant 3 weeks from the time they were brought in. They gave their heaviest yield at the end of 6 weeks and a good yield at 8 weeks. Similarly treated plants, placed in a cool cellar, gave their first product a little more than 2 months after planting and continued to yield for 2 months longer. Photographs are given of the products at different stages of growth, and the large development of waste product in leaves in plants grown in light over plants grown in darkness is brought out.

The cooking qualities of plants grown in darkness and in light were tested. Sauce made from stalks grown in the light was less attractive in appearance than that made from stalks grown in darkness. Its flavor, however, was more pronounced. The attractiveness of the sauce seems to depend upon the method of cooking and the color of the stalk, while the color of the stalk is influenced by conditions under which it grows. Thus stalks grown in darkness were more delicately colored than those grown in the light, and stalks from the cooler dwelling-house cellar were much brighter and more highly colored than those grown in the warmer position beneath the greenhouse bench. Hot water applied to the stalks at first seemed to extract much of the color. Sugar should be added to the sauce after it has cooked rather than before, as otherwise "the acid present in the rhubarb acts upon the sugar, changing it into glucose, and the higher the temperature the more rapidly does this change go on."

Fertilizer experiments with vegetables, R. OTTO (*Gartenflora, 48 (1899), No. 21, pp. 563–570*).—The effects of compost and stable manure alone, and of various commercial fertilizers alone and in different combinations, on turnips, head lettuce, and kohl-rabi were studied in a series of plat experiments. The largest total yields and the heaviest and best plants were obtained in every instance from the plats fertilized with stable manure. Compost stood second in the case of kohlrabi, and, with regard to size, of both turnips and lettuce. The second best yield of lettuce was obtained with kainit and superphosphate, and the second best yield of turnips with nitrate of soda.

The chemical composition of the kohl-rabi on the plats differently fertilized was determined. The greatest amount of dry matter, 13.81 per cent in the fresh heads, was found in the plants which had been fertilized with superphosphate. The lowest amount, 8.24 per cent, was found in the plants which had received stable manure. The highest nitrogen content, 5.42 per cent, was found in the plants fertilized with stable manure. In general the nitrogen content was highest in the plants which received nitrogenous manures, and lowest where only phosphate or potash manures were applied.

The ash content was greatest in plants fertilized with superphosphate, 11.19 per cent, and kainit, 11.07 per cent, and lowest in the plants which had received nitrate of soda, 8.76 per cent.

Some reports from trial stations on new orchard fruits and shrubs, J. L. BUDD (*Iowa Sta. Bul. 41, pp. 65–129*).—A report is given on the value of a number of varieties of fruits, ornamental trees, and shrubs which were obtained from central Asia, northwest China and Mongolia, and the Steppes of eastern Europe and planted at the station and sent out for trial. The data collected is in the form of replies to a circular of inquiry sent out by the station in November, 1898, to persons to whom material had been distributed between the years 1883 and 1894. The replies deal with the development, hardiness, and worth of apples grown in 65 different localities, pears in 24, cherries in 81, plums in 68, peaches in 39, and shrubs in 26. These localities differ widely in elevations, soils, and exposure, and extend over a wide range of latitude and longitude.

Results thus far secured attest the "remarkable hardiness of many of the east European trees and shrubs," and it is believed by the author that "their introduction will lead to natural and artificial crossing that will improve the fruits in size and quality and yet retain a large part of the hardiness of the mothers."

A contribution to the study of the culture of the olive, B. FLAMINIO (*Rev. Cult. Coloniales, 4 (1899), No. 30, pp. 323–332*).—This article is a translation of a bulletin of the experimental oil mill at Corenzo, Italy, and relates principally to a revision of fertilizer formulas for the olive.

The first part is devoted to a review and criticism of the work of previous investigators on the subject. Analyses are reported showing the ratio of pit to pulp, percentage composition, ash analyses of the wood and leaves removed in pruning, and whole fruit and different parts of the fruit. The facts that branches differ much in composition at different ages and that there is a great difference in the ratios between wood and bark in fresh and air-dried wood were taken into consideration in computing fertilizer formulas for the olive, with results differing materially from those of previous investigators. The relation between the weights of the green wood and bark was found to vary in the branches ordinarily removed in pruning, according to the age. In the case of branches only 1 or 2 years old the ratio of green wood to bark was 1.14:1, while in the case of branches 6 years old it was 6:1. These ratios become 1.15:2 and 8.7:2 for the air-dry substances, and the difference between them increases in proportion as the branch increases in size. The composition of the ash of wood removed in pruning and the leaves and fruit of the olive as determined by the author was as follows:

Composition of the ash of pruning wood, leaves, and fruit of the olive.

Ash constituents.	Wood.	Leaves.	Fruit.
	Per cent.	*Per cent.*	*Per cent.*
Potash	20.557	18.680	56.299
Phosphoric acid	15.386	7.676	6.554
Soda	11.376	8.510	4.828
Lime	30.940	35.639	5.708
Other mineral substances	21.741	29.495	26.611
	100.000	100.000	100.000

To make practical application of the above results, the fertilizer requirement of an orchard of 470 trees was estimated. In this orchard there were removed on the average each year by pruning 1,238 kg. of wood and 228 kg. of leaves. To this was added the losses from all other causes, which are estimated at one-sixth of the loss by pruning or a total loss of 1,445 kg. of wood and 226 kg. of leaves. The average yield of fruit per hectare per year is estimated to be 3,150 kg. From these figures, fertilizer constituents removed from a hectare in a year are computed to be as follows:

Fertilizer requirements of olives per hectare.

Fertilizer constituents.	Wood.	Leaves.	Fruit.	Total.
	Kgs.	*Kgs.*	*Kgs.*	*Kgs.*
Nitrogen	10.943	2.683	14.244	27.870
Potash	5 645	1.503	30.041	37.189
Phosphoric acid	4.226	0.618	3.496	8.340
Lime	8.500	0.268	3.046	11.814

The above totals are equivalent to about 25 lbs. of nitrogen, 33 lbs. of potash, 7½ lbs. of phosphoric acid, and 10½ lbs. of lime per acre.

Physiological observations on vines acclimated in the Southwest. Influence on the quality of the wine of different methods of pruning, G. HÉRON (*Prog. Agr. et Vit., 16 (1899), No. 38, pp. 338–344*).—In addition to data on the production of must, wine, and the yield per vine of 14 varieties of grapes, which served to demonstrate that the percentage of alcohol in the wines is not necessarily lessened because of an increased production of fruit but may, on the other hand, increase at the same time; a discussion and some details are given of experiments made to determine the alcohol content of wine made from grapes grown at the extremes of fruit branches as compared with bunches gathered from near the base of the vine and intermediate between these two positions; and also to determine the relative value of pruning to permanent cordons, and renewing each year.

Relative to the value of fruit gathered from different portions of the vine for wine making, the results showed that the alcohol content with 9 varieties was 0.44° greater with fruit gathered from near the base of the vine and 0.78° greater with 5 varieties from bunches picked near the extremity of the fruit branches. Vines pruned back to near the stump each year gave a higher alcohol content in the wine than vines trained to permanent cordons.

Fruit preservatives for exhibition purposes, F. C. HARRISON (*Ontario Agr. Col. and Expt. Farm Rpt. 1898, pp. 110–115*).—Tests were made of over 25 different mixtures to determine which would give the best results as a preservative of fruits for exhibition purposes. The fruits on which the present report is made had been kept 1 year and 4 months. The mixtures were made up with tap water. The colors of the various preserving liquids are stated and the effect of each on the shape and color of the various fruits is given. The experiments are being continued.

"It seems to be a very hard matter to find a mixture which does not take the color out of soft fruits, like strawberries or raspberries. For the former, coal oil has been used very generally; but we can not speak of it as an ideal mixture, viz, a clear, colorless liquid, which will preserve, for at least a period of one year, the color and shape of the fruit as it was when growing on the tree or bush. All the fruit herein referred to has been judged by the above standard as to color and shape.

"The best mixtures for the different kinds are as follows: For raspberries, formalin 1 cc., glycerin 10 cc., and water 89 cc., but this is not an ideal mixture, as the color of the fruit changes somewhat. For strawberries, formalin 2 cc., potassium alum 4 grains, glycerin 10 cc., and water 100 cc. The only objection to this mixture is the slightly yellowish tint of the liquid; but the fruit in it is of a better color and firmer than fruit pickled in coal oil. For this fruit a saturated solution of common salt makes a fairly good preservative. For red currants, several mixtures are fairly satisfactory. One of the best was 1 gm. of mercuric chlorid, 10 cc. glycerin, and 90 cc water. For white currants, two solutions did well; one with mercuric chlorid alone and the other with mercuric chlorid and common salt. For gooseberries, a number of mixtures are satisfactory; 1 per cent formalin gave very good results, as did also 2 per cent zinc chlorid."

Lessons from the great drought of 1898, E. MAWLEY (*Jour. Roy. Hort. Soc. England, 23 (1899), pt. 2, pp. 127–139, charts 7*).—The effects of garden mulching and watering on the moisture and temperature of the soil are shown by the aid of diagrams and tables.

On plant composition and manurial requirements, G. TRUFFAUT (*Jour. Roy. Hort. Soc. England, 23 (1899), pt. 2, pp. 140–150*).—The composition of 19 different vegetables and the fertilizing elements requisite for the growth of these crops are tabulated and discussed, and notes given on different soils and composts.

Forcing rhubarb, J. HOBSON (*Amer. Gard., 20 (1899), No. 257, p. 798*).—The forcing of rhubarb in cellars, pits, under benches in the greenhouse, in mushroom houses, and in frames heated by steam are considered.

The Jerusalem artichoke (Helianthus tuberosus), R. ZERSCH (*Mitt. Deut. Landw. Gesell., 14 (1899), No. 19, pp. 296, 297*).

Vanilla, R. LÓPEZ Y PARRA (*Bol. Soc. Agr. Mexicana, 23 (1899), Nos. 39, pp. 767–772; 40, pp. 790–794; 41, pp. 809–816; 44, pp. 872–876*).—A discussion of the history, uses, production, and marketing of vanilla beans.

Mushrooms on benches, R. MAXWELL (*Amer. Gard., 20 (1899), No. 255, p. 765, fig. 1*).—Growing mushrooms on top of benches instead of underneath is advocated and directions given for the preparation and care of the beds for this purpose.

Edible fungi (*Lancet [London], 1899, No. 3971, pp. 969, 970*) —A general article on edible and poisonous fungi. The comparatively low food-value of edible fungi is pointed out and their usefulness as condiments is spoken of.

Summer pruning, G. Quinn (*Jour. Agr. and Ind. South Australia, 3 (1899), No. 4, pp. 368-378, figs. 13*).—The subject is illustrated and discussed under the following heads: Disbudding to shape the tree and to reduce the overcrowding of fruit-bearing wood; pinching off terminal points of shoots to temporarily check their extension; shortening in wood which has been left to carry fruit but which has failed to do so either wholly or in part; and fracturing to induce the formation of fruit-bearing spurs.

Stringfellow method of root pruning (*Nat. Nurseryman, 7 (1899), No. 11, pp. 127, 128*).—Brief review of result secured in Oregon and Georgia (E. S. R., 10, p. 1010). Pruning to 3 in. stubs in Oregon has given excellent results with pears, apples, prunes, plums, and cherries on heavy clay soils. The root systems of such pruned trees were especially well formed.

Cooperative fruit testing, H. L. Hutt (*Ontario Agr. and Expt. Union Rpt. 1898, pp. 9-12*).—Report on cooperative fruit tests that have been in progress since 1894. The average yields of red raspberries, black raspberries, blackberries, strawberries, and gooseberries are given with notes on a few varieties of the last 3.

Improvement of the persimmon, J. H. Marion (*Missouri State Hort. Soc. Rpt. 1898, pp. 273-276*).—Fall planting, budding, crown grafting, and cleft grafting of 2-year-old seedlings in the nursery row have proven desirable features in the improvement of persimmons.

Pineapples for profit in Florida and Cuba, E. French (*Amer. Gard., 20 (1899), Nos. 261, pp. 877, 878; 262, pp. 895, 896*).

The currant vine, T. Hardy (*Gard. and Field, 25 (1899), No. 5, pp. 101, 102, figs. 7*).—Complete cultural directions including methods of pruning, training, etc., of Zante currants.

A valuable new strawberry, the Rough Rider, L. J. Farmer (*Amer. Gard., 20 (1899), No. 261, p. 882*).—Notes on the origin and value of this strawberry.

Fifty years' improvement in American grapes, T. V. Munson (*Amer. Gard., 20 (1899), Nos. 246, pp. 620-623, fig. 1; 250, pp. 688-690, fig. 1; 254, pp. 750-752, fig. 1; 261, pp. 868-870, fig. 1*).—A series of articles forming a complete survey of our native grapes, and including a list of the leading families and varieties of grapes originated by the author, showing parentage, color, season, etc.

The use of commercial fertilizers in the culture of the vine, L. Degrully (*Prog. Agr. et Vit., 16 (1899), No. 5, pp. 669-673*).—Some results are given showing the value of commercial manures for vines on 4 sandy hill soils.

A new protection against spring frosts, L. Degrully (*Prog. Agr. et Vit., 16 (1899), No. 49, pp. 637-641, figs. 8*).—A specially prepared paper cover for protecting grapes against early spring frosts is described and methods of wrapping the paper on vines illustrated.

Flower and fruit farming in England, W. E. Bear (*Jour. Roy. Agr. Soc. England, 3. ser., 10 (1899), pt. 2, pp. 267-313*).—A thoroughgoing discussion of the development and present status of flower and fruit farming in England, considered as hothouse industries.

The florists' tulip: Its origin, history, and classification, R. Dean (*Amer. Gard., 20 (1899), No. 261, pp. 866-868, figs 3*).

Review of garden clematises, K. C. Davis (*Amer. Gard., 20 (1899), Nos. 257, pp. 803, 804; 260, pp. 846-848, fig. 1*).—Cultural, botanical, and descriptive notes on garden clematises.

The principles and practice of fern culture, W. C. Worsdell (*Gard. Chron., 3. ser., 26 (1899), Nos. 663, p. 201; 664, pp. 220, 221*).—The subjects of temperature, moisture, soil, spore seeding, etc., are considered.

Rock gardens, ponds, and streamlets in our pleasure grounds, F. W. Meyer (*Jour. Roy. Hort. Soc. England, 23 (1899), pt. 2, pp. 78-95*).—The laying out and planting of rock gardens, ponds, and small streams are discussed, and 15 lists given of plants suitable for planting.

Some valuable indexes, W. Miller (*Amer. Gard., 21 (1900), No. 263, p. 6*).—Information is given as to where indexes to a number of horticultural periodicals may be found.

WEEDS—DISEASES OF PLANTS.

The horse nettle and other troublesome weeds in Iowa, L. H. PAMMEL (*Iowa Sta. Bul. 42, pp. 131–140, figs. 3, maps 2*).—Notes are given on the horse nettle (*Solanum carolinense*) which is rapidly spreading throughout the State and becoming one of the most troublesome perennial weeds. Its spread throughout the United States is treated historically, and maps given showing its present known range. It appears that this weed is found from Massachusetts southward to the Gulf and westward to Iowa, Nebraska, Kansas, and Texas. Its methods of propagation are by means of seed, and also its rootstocks. Means for extermination are given, from which it appears that probably the most effective and least expensive method of removing this plant is by smothering it with some rapidly growing crop, such as rape. Planting corn or roots is a method much employed, as the cultivation given greatly reduces the spread of the weed. Cutting and burning the weeds when in advanced stage of growth will prevent the production of seed, and to that extent prevent the spread of the pest.

The other weeds mentioned are the European bindweed or morning-glory (*Convolvulus arvensis*) and *Tribulus terrestris*. Both of these weeds are described at some length. For the first, which is a perennial, the same methods of destruction given for the horse nettle are recommended. The last weed is an annual, and the methods usually employed for the destruction of annual weeds may be adopted against it.

Potato scab, C. R. BALL (*Iowa Sta. Bul. 42, pp. 141, 142*).—A brief report is given upon some experiments conducted for the prevention of potato scab. Soaking the seed tubers in corrosive sublimate solution resulted in a crop about 9 per cent of which were more or less scabby, the check plats giving 31 per cent diseased tubers. Formalin and potassium sulphid were also used with beneficial results, and although some of these treatments tend to reduce the total yield slightly, the increase in larger and cleaner tubers more than compensates for the loss.

Bindweed and rib grass, W. LOCHHEAD (*Ontario Agr. Col. and Expt. Farm Rpt. 1898, pp. 13, 14, figs. 2*).—Brief notes are given of these two weeds with suggestions for their eradication.

Extirpation of prickly pear, E. PILLANS (*Agr. Jour. Cape Good Hope, 15 (1899), No. 8, pp. 548–551*).—Notes the efficiency of arsenical sprays for the destruction of this pest. The government has aided in this work by supplying the materials, about 1,000 cases of 135 lbs. weight having been supplied.

Apple scab and peach-leaf curl, W. LOCHHEAD (*Ontario Agr. Col. and Expt. Farm Rpt. 1898, pp. 14–19, figs. 3*).—Popular descriptions are given of these two diseases and of the fungi which cause them, and suggestions offered for their prevention. For the first, spraying with carbonate of copper solution or Bordeaux mixture is recommended, and for the second, thorough pruning together with the application of Bordeaux mixture is said to hold the disease in check.

On the use of copper acetate as a fungicide, E. ROCCA (*Prog. Agr. et Vit. (Éd. L'Est), 20 (1899), No. 51, pp. 710–712*).—By evaporating a mixture of copper acetate and sodium sulphate the author claims an insoluble basic compound of great value as a fungicide is obtained. It is said to be very adhesive, traces being apparent on grape leaves in November that had been sprayed in June.

The bacteria of wine disorders, A. BOUFFARD (*Prog. Agr. et Vit. (Éd. L'Est), 20 (1899), No. 49, pp. 643–646, pl. 1*).

Concerning the effect of molds on arsenic and its compounds, R. ABEL and P. BUTTENBERG (*Ztschr. Hyg. u. Infectionskrank., 32 (1899), No. 3, pp. 449–490*).—The authors claim that the peculiar growth of *Penicillium brevicaule* gives a biological test for the presence of arsenic and its compounds. An extensive bibliography is appended.

ENTOMOLOGY.

Report of the apiarist, R. F. HOLTERMANN (*Ontario Agr. Col. and Expt. Farm Rpt. 1898, pp. 197–208, figs. 9*).—Experiments were conducted to determine the value of good ventilation and a constant temperature in wintering bees. It was found that any changes in temperature during the time the bees were kept in a wintering cellar caused disturbances among the bees and a consequent loss of vitality. Where the temperature was kept constant the bees were much less active and consumed less of their stores. In some instances strong colonies consumed as little as 4¼ lbs. from November 21 to March 23. The temperature was kept at about 42° F.

No brood is produced in hives which are kept at this constant temperature and are prevented from being disturbed. Considerable brood forming was, however, noticed in hives which were troubled with frequent changes in temperature.

The advantages of an artificial arrangement for delivering heat to the bees during wintering and of a specific means of ventilation are that the air is kept pure, that moisture is removed from the colonies, and that the temperature remains constant.

The records for 53 colonies wintered in the cellar showed an average consumption of 12 lbs. per colony from November 18 to April 3. The author maintains that from his experience bees always suffer considerably from outdoor wintering, provided no special arrangements are made for ventilation and the removal of excess of moisture.

The author figures and describes a swarm catcher which is somewhat like a hopper in shape and into which the bees are allowed to crawl at the time of issuing from the mother hive. The catcher is then stood on end until the bees cluster, and is then opened in front of the hive into which the bees are to be introduced.

Experiments with Carniolan bees showed that they produce an excellent quality of comb honey, but have a tendency to excessive swarming.

Experiments were tried in moving bees to fall pasture, especially to buckwheat fields, and the result showed that if the moving is done with ordinary care the increase in the amount of honey made will more than pay for the trouble of moving.

Report on apicultural experiments, R. F. HOLTERMANN (*Ontario Agr. and Expt. Union Rpt. 1898, pp. 71, 72*).—A brief statement is given of the results obtained by the Experimental Union during the year. It was found that the quantity of base left in a comb was directly in proportion to the thickness of the base of the comb foundation, and that the bees could not be depended upon for thinning. The 5-banded Italian bees are not considered desirable for honey-gathering purposes.

In experiments on the specific gravity of honey it was found that the higher the specific gravity the better the quality and aroma of the honey.

Tabanidæ, and a simple method for destroying them, I. PORCHINSKI (*Selsk. Khoz. i Lyesov., 192 (1899), Mar., pp. 557-573*).—About 100 species of Tabanidæ are known in Russia, of which 60 belong to Tabanus, 18 to Chrysops, 6 to Hæmatopota, and the others to Nemorius, Silvius, Hexatoma, and Pangonia. The more common species are *Tabanus tropicus*, *T. montanus*, *T. luridus*, *Hæmatopota pluvialis*, and *Chrysops relictus*. The larger species produce a buzzing sound in flying and attack any part of the body of the animal, although they seem to prefer the neck and belly. Chrysops flies almost without noise, and in the case of horses, alights preferably near the base of the mane.

Water and forest vegetation furnish the proper conditions for the multiplication of Tabanidæ. Where these conditions are not present, as in the treeless steppes of central Asia, Tabanidæ are not found. The Tabanidæ fasten their dark brown spindle-shaped eggs to the leaves and stems of plants, or in the case of species with aquatic larvæ, to rushes. The eggs are glued together in spherical or flattened masses of from 300 to 400. The larvæ hatch within 9 to 12 days. At this stage the body is elongated and cylindrical, the abdominal rings are furnished with soft warty projections on the ventral surface which assist the larvæ in locomotion. In the majority of species there is a respiratory slit in the terminal abdominal segment, and in aquatic species the last two segments form a respiratory tube.

The larvæ of Tabanidæ are predaceous and feed upon the larvæ of other insects. They have been observed preying upon the larvæ of species of Helops and Rhizotrogus. The larvæ of aquatic species, as, for example, *T. autumnalis* and *Hexatoma bimaculata*, attack fresh water Mollusca.

Bembex is a rather effective enemy of the Tabanidæ. It was observed that the gadflies take water at frequent intervals during the adult stage, by darting down upon the surface of pools. The author, therefore, tried experiments in the destruction of Tabanidæ by covering the pools of water with a film of kerosene. Then, in attempting to take water from these pools, the flies came in contact with the oil and were unable to fly away, or, if they escaped, they died later from the effects of the oil. As the surface of the pools became covered with dead flies, it was found necessary to pour on more oil. The following species were found dead upon the pools: *T. bovinus*, *T. tropicus*, *T. montanus*, *T. luridus*, *T. borealis*, *T. maculicornis*, *Chrysops relictus*, and *C. cæcutiens*. Hæmatopota does not visit the pools, and is therefore not to be destroyed by this method.

Recent work on the San José scale in Illinois, S. A. FORBES (*Illinois Sta. Bul. 56, pp. 241–287, pls. 4*).—This bulletin recounts in detail the work of the entomological department, especially of the field assistants, in locating new areas of infection, inspection of nurseries, insecticide treatment, and distribution of fungus diseases for destroying the San José scale.

The principal apparatus used in spraying was a machine sprayer consisting of a 1-horsepower gasoline engine, 3-cylinder force pump, and double galvanized iron tank with a gasoline heater for making the whale-oil soap solution. The wagon when thus loaded with this apparatus weighed 2,400 lbs. The gasoline in the engine is exploded by an electric spark. The tank is made of heavy galvanized iron and holds 170 gal. Underneath the tank are placed 2 sets of gasoline burners for the purpose of heating the solution. The capacity of the pump is from 2.8 to 4.2 gal. per minute, and the pump will operate against 150 lbs. pressure per square inch.

The insecticides used were whale-oil soap solution, pure kerosene, and kerosene and water mixture. It is estimated that 99 per cent of the San José scale in one orchard in which a large number of trees were sprayed was killed by 2 successive sprayings with whale-oil soap in the fall of 1896 and in the spring of 1897. In one case maple trees were badly damaged by the spray of whale-oil soap. The Forbes scale was destroyed rather effectively, but the scurfy scale was little affected by a winter application of whale-oil soap. Subsequent inspection in the orchard where these spraying experiments were carried out indicated that 9 out of 21 places which were treated were free from the San José scale. Those places, however, in which the scale was completely exterminated were not badly infested. The spraying method can not be depended upon for exterminating the scale where it has had a few years to establish itself. The San José scale can, however, be effectively checked by thorough and repeated spraying with whale oil soap at intervals to be determined by inspection in each case. Whale-oil soap solution was used in the strength of 2 lbs. to the gallon of water. The trees were usually pruned back, and where the bark was rough the trees were scraped.

Experiments were conducted in infecting San José scale with 2 parasitic fungi, *Sphærostilbe coccophila* and a species of Microcera. Infection by means of the first-named species was carried out in 2 ways, by hanging branches upon which were found infected scales in trees infested with the San José scale, and by placing portions of artificial cultures of the fungus in the infested trees. The results obtained from both methods of infection were quite successful, perhaps more markedly so in the case of artificial cultures, but these fungi will probably not be able to control the San José scale without the aid of artificial insecticides.

Some experiments were tried with pure kerosene in the month of June. The results were quite unsatisfactory. If the kerosene was used in sufficient quantity to kill the scales, the trees were badly injured or destroyed. Experiments made with mechanical mixture of kerosene and water showed that mixtures containing 5, 15, and 20 per cent of kerosene did not injure the trees, but also did not kill the scales. A 30 per cent mixture killed nearly all the scales, but did not injure the trees. A few experiments were tried with mixtures of Carboleum, but not enough to warrant any final conclusion.

The scales were found on Ambrosia, Lepidium, and Solanum. Some observations made upon the rate of travel of the young indicated an average rate of 1.1 in. per minute. The only insect enemies mentioned as of much importance are *Pentilia misella* and *Chilocorus bivulnerus*.

Investigations on scale insects upon American fruit, L. REH (*Station für Pflanzenschutz zu Hamburg, 1 (1898–99), pp. 19*).—The author gives detailed notes on the position upon the fruit in which scale insects were found. The notes cover all the more common species of scale insects. It has been stated as a general principle that scale insects establish themselves in a position upon the fruit which offers them protection from the sun and rain. The author found, however, that only 2 species were evidently sensitive to these influences (*Aspidiotus ancylus* and *A. forbesi*), but that in general the distribution of scale insects on fruit is determined by the sensitiveness of the scales.

Of the 262 specimens of *A. ancylus* which the author found, 250 were females and 12 larvæ. Only 17 specimens of *A. forbesi* were found, and these were all males. Of the San José scale, the author discovered 82 males, 354 females, and 259 larvæ. Thirty-three specimens of *A. camelliæ*, all of which were females with one exception, were found. Of the specimens of *Chionaspis furfurus* discovered, 115 were females, 17 males, and 1 larva. Of *A. ancylus* 92.75 per cent were alive. Sixteen of the 17 *A. forbesi* were still alive, and of the San José scale 33 per cent were alive. Upon many apples several species of these scales occurred together, and notes are given of the relative frequency of various combinations.

The author conducted a number of experiments for the purpose of determining the danger from the packing of imported fruit, with the general result that living scales were very seldom found in such material. Experiments were also instituted to determine how long the scale insects would live when removed from the fruit and carefully transported to other fruit or to other situations. The experiments indicate that death usually results within a short period after such removal.

American fruit and its parasites, C. BRICK (*Station für Pflanzenschutz zu Hamburg, 1 (1898–99, pp. 34*).—The author made extensive observations on fruit which was imported from America with reference to determining the extent of its infestation by injurious insects and fungus diseases. Detailed notes are given on the following insects which were found upon apples: *Aspidiotus ancylus, A. camelliæ, A. forbesi, A. perniciosus, Chionaspis furfurus,* and *Mytilaspis pomorum.* Two fungus diseases were observed upon apples, *Venturia inæqualis* and *Leptothyrium pomi.*

Special notes are given on the species of scales found upon the different varieties of apples which were imported from different parts of the United States, Canada, and South America. The San José scale was found on Ben Davis from Virginia, on Newtown Pippins from California, and on pears from California. During the period of the author's observations, San José scales were found in 26 barrels and 582 boxes of apples and in 1 box of pears.

With regard to the extent of infestation, the author states that for the most part it was very slight. He also gives notes on dried American fruit, including apricots, pears, cherries, nectarines, and plums. Some scale insects were found upon such fruit, but in nearly every case the scales were evidently dead.

The estivation of the Chrysomelidæ, W. KOLBE (*Ztschr. Ent., n. ser., 1899, No. 21, pp. 26–37*).—The author made observations upon a large number of species of this family for the purpose of determining to what extent they enter into a summer sleep or resting condition. Among the genera which were studied may be mentioned Phytodecta, Lema, Zeugophora, Agelastica, Gallerucella, and Galeruca. All of these genera were observed to pass through a period of estivation, beginning ordinarily with the month of June and ending with the latter part of August or the first part of September. At this latter date the beetles were usually noticed to be in rather active condition and then later to enter upon their regular hibernation period for the winter.

The author believes that this resting period during the summer and a subsequent short active period during the fall may account for the supposed double-brooded condition of many species which are really single brooded. With species of Phytodecta, it was experimentally determined that no changes in the amount of moisture in the air or in the presence of suitable food material were sufficient to arouse the beetles from their resting condition. In the opinion of the author, the majority of the Chrysomelidæ pass through a period of summer sleep.

Observations on the subject of driving away parasites of plants by means of intraorganic injections, A. BERLESE (*Riv. Patol. Veg., 8 (1899), Nos. 1–6, pp. 166–182, figs. 2*).—Experiments were made chiefly upon living specimens of *Urtica urens*. The roots were kept in a solution of cyanid of potash in the proportion of 5 to 2,000.

The author concludes from a series of experiments that injection or imbibition of substances within the plant must be limited, even as a possibly successful remedy, to insects of a sedentary habit. Other means must be used against the great majority of insects. The method proposed by Perosino is not satisfactory, since even if the desired effect is obtained, it is only temporary. The effects of internal insecticides upon the plants themselves and fruits should be studied more carefully. The roots of plants seem to exercise a sort of selective action and refuse to take up certain substances.

Memorial of life and entomologic work of Joseph Albert Lintner, E. P. FELT (*Bul. New York State Mus., 5 (1899), No. 24, pp. 301–611, pl. 1*).—This bulletin contains a brief biological notice of J. A. Lintner, a list of the species described by him, a bibliography of his entomological publications, and a general index to reports 1 to 13 of the State entomologist of New York.

Bees and how to manage them, A. GALE (*Agr. Gaz. New South Wales, 10 (1899), No. 10, pp. 1092–1098, figs. 2*).—Directions for securing wild swarms of bees from trees.

Prevention of the swarming of bees, R. PINCOT (*L'Apiculteur, 43 (1899), No. 11, pp. 495–500*).

The parthenogenetic origin of drones, W. PAULCKE (*Anat. Anzeiger, 16 (1899), No. 17–18, pp. 474–476, figs. 2*).—The author's results, based on a microscopic study of a large number of eggs, favor the Dzierzon theory.

Observations on the metamorphosis of insects, J. E. V. BOAS (*Zool. Jahrb., Abt. Syst., 12 (1899), No. 4, pp. 385–402, pl. 1, fig. 3*).—This paper reports the study of certain points in the development of *Pyrrhocoris apterus*, Myrmeleon, Cossus, Cetonia, Cimbex, and other insects.

Report on economic entomology for 1898, G. H. CARPENTER (*Reprint from Rpt. Council Roy. Dublin Soc. 1898, pp. 14, figs. 13*).—Notes on *Phyllotreta nemorum, Melolontha vulgaris, Bruchus affinis, Myzus cerasi, M. ribis, Eriocampoides limacina, Bryobia prætiosa, Chermes abietis*, and *Lachnus piceæ*.

Notes on Aphididæ, N. CHOLODKOVSKY (*Zool. Anz., 22 (1899), No. 602, pp. 468–477, figs. 7*).—The author gives descriptive and biological notes on a number of species of plant lice, among which may be mentioned *Chermes funitectus, Lachnus piceæ, L. persicæ, L. maculosis, L. abieticola, L. rosæ, Stomaphis graffii, Callipterus giganteus, Tetraneura ulmi, Phylloxera quercus*, and species of Schizoneura and Mindarus. A number of these species are described as new.

A few of the most noxious insects, W. LOCHHEAD (*Ontario Agr. Col. and Expt. Farm Rpt. 1898, pp. 11–13, figs. 4*).—Contains popular notes on *Aphis brassicæ*, tent caterpillar, larch sawfly (*Nematus erichsonii*), and Lecanium sp.

Coccidæ, TRABUT (*Gouv. Gen. Algeria, Serv. Bot. Bul. 19, 1899, pp. 59–74, figs. 24*).—A brief account of the more common and injurious scale insects, with recommendations of the more efficient remedies against them.

The San José scale and other scale insects, and the Indiana nursery inspection law, J. TROOP (*Indiana Sta. Bul. 78, pp. 45–52, figs. 3*).—This bulletin contains brief notes on the San José scale, the oyster-shell bark-louse, the scurfy bark-louse, and the Putnam scale (*Aspidiotus ancylus*). The commonly used insecticides are recommended against these insects. The full text of the nursery inspection law of Indiana is printed with the bulletin.

On the larvæ of certain Aspidiotus species, W. MAY (*Station für Pflanzenschutz zu Hamburg, 1 (1898–99), pp. 5*).—Brief notes on the larvæ of *Aspidiotus perniciosus, A. ancylus, A. camelliæ*, and *A. ostreæformis*.

On the North American species of the subgenera Diaspidiotus and Hemiberlesia of the genus Aspidiotus, W. NEWELL (*Contrib. Dept. Zool. and Ent. Iowa State Col. Agr. and Mech. Arts, 1899, No. 3, pp. 31, pl. 1*).

European scales on fruit, L. REH (*Illus. Ztschr. Ent., 4 (1899), No. 23, p. 361*).—Notes on *Aspidiotus ostreæformis*.

Insect enemies of citrus fruits, E. ARNAO (*La coltivazione degli agrumi. Palermo: A. Reber, 1899, pp. 279–328, figs. 20*).—A general discussion of the insect enemies of these fruits with special reference to species of Aspidiotus, Mytilaspis, Parlatoria, Lecanium, and Dactylopius. The author also reports upon the remedies which have given best results in combating the various insect pests.

Imported pests, G. VERT (*Bol. Soc. Nac. Agr. Brazil, 2. ser., 1899, Nos. 2, pp. 34–39; 3, pp. 67–68; 4, pp. 98–101, figs. 3, pls. 4*).—Brief accounts of San José scale, phylloxera, and *Margarodes vitium*.

Report on the distribution of phylloxera in Austria (*Bericht über die Verbreitung der Reblaus in Österreich im Jahre 1897. Vienna: Imp. Roy. Agr. Min., 1899, pp. 164*).—A detailed statement is given of the extent and spread of infestation by Phylloxera. The use of American stock is recommended and the application of bisulphid of carbon. Various laws and decrees are printed in this report concerning the treatment of vineyards and the spread of phylloxera.

New experiments in the destruction of phylloxera, G. COUANON, J. MICHON, and E. SALMON (*Compt. Rend. Acad. Sci. Paris, 129 (1899), No. 20, pp. 783, 784*).—Young grapevines were entirely freed from phylloxera by immersion for from 3 to 5 minutes in water at a temperature of 53° C. The vines were uninjured by the hot water treatment, and when planted, exhibited vigorous vegetative growth.

Experiments in destroying phylloxera, LANFREY (*Compt. Rend. Acad. Sci. Paris, 129 (1899), No. 22, p. 865*).—One kilogram of picric acid was dissolved in 90 liters of water. One liter of this solution was poured about the roots of each vine. It proved a very successful remedy. The months of June, July, and August seemed most opportune for the application of this solution.

Insects injurious to cereals, V. MAYET (*Prog. Agr. et Vit. (Éd. L'Est), 20 (1899), No. 45, pp. 526–536, pl. 1*).—This paper contains an account of the appearance, life-history, habits, natural enemies, and artificial remedies of *Oscinis frit, Chlorops lineata, Cecidomyia destructor*, and *C. tritici.*

The influence of a mild winter upon the first flight of the Geometridæ, NAGEL (*Ztschr. Ent., n. ser., 1899, No. 24, pp. 38, 39*).—The winter of 1898–99 having been especially mild, the author was led to observe the time of flight of the first individuals of certain genera of Geometridæ. It was found that their occurrence was unusually early in the season. The individuals observed were of the genera Hibernia and Phigalia.

Australian case or bag moths, W. W. FROGGATT (*Agr. Gaz. New South Wales, 10 (1899), No. 10, pp. 1085–1091, pl. 1*).—Gives biological notes on the following species: *Metura elongata, Thyridopteryx herrichii, T. hubneri, T. boisduvali, Entometa ignoblis, Clania lewinii, and Oiketicus macleayi.*

The life cycle of the Coccidia and Hæmosporidia, F. SCHAUDINN (*Zool Centbl., 6 (1899), No. 22, pp. 765–783*).—In this article the author has brought together the literature of the subject in an extensive bibliography. A critical examination of the results thus far obtained is presented. The forms of Sporozoa which received most attention are species of Coccidium, Plasmodium, Halteridium, and Proteosoma.

Vaginula slugs, H. TRYON (*Queensland Agr. Jour., 5 (1899), No. 1, pp. 63–70, pl. 1*).—Two species of slugs (*Vaginula hedleyi* and *V. leydigi*) are reported as causing considerable damage to the majority of garden vegetables. The slugs are figured and described. The eggs are deposited under logs or stones in masses of 40 or more. Domestic poultry, birds, toads, and frogs have not been observed to eat the slugs. Tobacco waste and lime spread upon infested ground have a deterrent effect upon the vaginulas. Poisoned bran is also recommended as an artificial remedy. Old boards and wet sacks placed on the ground serve as hiding places for the slugs, and in the daytime they may be found in such situations and easily destroyed.

Agrotis saucia and one of its new forms, W. CASPARI (*Jahrb. Nassauischen Ver. Naturkunde, 52 (1899), pp. 185–201*).

Treatment for the potato beetle, C. A. ZAVITZ (*Ontario Agr. Col. and Expt. Farm Rpt. 1898, pp. 157, 158*).—Experiments were conducted upon potatoes with the object of determining the relative efficiency of Paris green in water, Paris green with plaster, and a proprietary insecticide known as "potato bug finish," in the destruction of potato beetle. Tests were carried through 2 years, and the results showed that the best form of insecticide for this insect was Paris green dissolved in water.

Combating the enemies of field crops, V. MORACHEVSKY (*Selsk. Khoz. i Lyesov., 194 (1899), Sept., pp. 445–454*).—A discussion of the depredations of and remedies to be used against the following insects: *Agrotis segetum, A. exclamationis, Anisoplia austriaca*, and the Hessian fly.

Combating the enemies of field crops, V. MORACHEVSKY (*Selsk. Khoz. i Lyesov., 194 (1899), Aug., pp. 193–225*).—This article is occupied with a discussion of the Acrididæ and for the greater part with *Pachytylus migratorius* and *Caloptenus italicus.* Among the remedies which are used in the different provinces of Russia against these insects may be mentioned thorough cultivation and harrowing of the infested lands, burning of straw, crushing the nymphal locusts with various farm implements, the use of ditches, catching the locusts with various contrivances, and infection with *Empusa grylli*.

Crop pests, remedies and spray pumps, G. McCarthy (*Bul. North Carolina State Bd. Agr., 20 (1899) No. 12, pp. 10–25, figs. 6*).—Brief descriptions of a number of injurious insects and fungus diseases, and a spray calendar with directions for making the common insecticides and fungicides.

Fruit protection, E. J. Wickson (*California Fruits and How to Grow Them. San Francisco: Pacific Rural Press, 1900, pp. 434–464, figs. 30*).—A general discussion of the habits, life history, and means of combating the common noxious insects, rabbits, gophers, and birds.

The use of Sporotrichum globuliferum in combating insects, Trabut (*Gouv. Gen. Algeria, Serv. Bot. Bul. 19, 1899, pp. 58, 59, figs. 2*).—Reports the successful application of this fungus in destroying Haltica, Pemphigus, and species of locusts.

A brief report on locust fungus, D. McAlpine (*Agr. Gaz. New South Wales, 10 (1899), No. 11, p. 1213*).—A fungus which has been used against locusts at Cape Good Hope with good success was introduced into New South Wales and identified by the author as *Mucor racemosus*.

Locust destruction (*Agr. Jour. Cape Good Hope, 15 (1899), No. 7, pp. 480–483*).—Careful directions for the use of the locust fungus in combating these pests.

An insect powder duster for plants (*Sci. Amer., 81 (1899), No. 26, p. 404, figs. 4*).—A description of a blowgun provided with an apparatus for regulating the supply of powder to the discharge tube.

Rules and regulations of the Montana State Board of Horticulture (*Missoula: Montana State Bd. Hort., 1899, pp. 12*).—The act creating the board and prescribing its powers and the rules and regulations of the board, including the formulas prescribed for the treatment of insects and fungus diseases affecting nursery stock are given.

FOODS—ANIMAL PRODUCTION.

The relative digestibility of several sorts of fat by man. I, Margarin and natural butter, H. Lührig (*Ztschr. Untersuch. Nahr. u. Genussmtl., 2 (1899), No. 6, pp. 481–506*).—The author reviews the literature of the subject and reports results of 4 experiments on the digestibility of margarin and butter made with a healthy man, 29 years old, weighing 74 kg. Holstein butter and 3 sorts of margarin were used, called, according to their quality, No. 1, 2, and 3. The tests were quite similar, the fat in each case forming part of a mixed diet of meat, bread, vegetables, etc. The composition of the margarin and butter was determined and the fat content of all the articles of diet. The average results of the tests follow:

Average digestibility of margarin and butter.

	Fat.		
	In daily food.	In daily feces.	Digested.
	Grams.	*Grams.*	*Per cent.*
Margarin No. 1, consumed with mixed diet 6 days	138.35	4.62	96.68
Margarin No. 2, consumed with mixed diet 4 days	118.64	3.91	96.70
Margarin No. 3, consumed with mixed diet 4 days	112.89	3.46	96.93
Butter, consumed with mixed diet 4 days	111.79	4.82	95.69

If corrections are made for the fat in the food supplied by other materials than margarin or butter, the average coefficients of digestibility in the 4 tests are 97.35, 97.39, 97.90, and 96.53 per cent, respectively. The author studied the undigested fat in the 4 experiments and determined the amount of true fat in the undigested ether extract. Taking account of these values, the corrected digestibility of the margarin and butter fat in the tests reported above is 98.31, 98.25, 98.46, and 97.77 per cent, respectively. In the author's opinion the true undigested fat was not butter or margarin fat, and accordingly he believes that it is safe to conclude that butter and margarin are completely digested. The fat recovered in the feces is believed to be derived from the digestive juices and metabolic products produced in the body during the experiment. If it is insisted upon that the 2 kinds of fat are not completely digested, it must still be granted that as regards digestibility they are practically alike, since the difference is very small.

The relative digestibility of several sorts of fat by man. II, Palmin, H. LÜHRIG (*Ztschr. Untersuch. Nahr. u. Genussmtl., 2 (1899), No. 8, pp. 622–632*).—In continuation of previous work (see above) the author studied the digestibility of Palmin, a commercial preparation which is evidently a pure cocoanut butter. It is stated that this has a nutty odor and taste, and may be kept a long time without spoiling. Tests were made which showed that it was free from micro-organisms. The digestibility of this material was tested with the same subject as in the experiments referred to above. Two tests are reported. In the first 136 gm. of Palmin was taken daily for 3 days, and in the second, 90 gm. The Palmin formed part of a simple mixed diet of meat, bread, tropon, vegetables, etc. The average results of the tests follow:

Average digestibility of Palmin.

	Fat.		
	In daily food.	In daily feces.	Digested.
	Grams.	*Grams.*	*Per cent.*
First test, Palmin (cocoanut butter), consumed with simple mixed diet for 3 days	139.31	3.74	97.31
Second test, Palmin (cocoanut butter), consumed with simple mixed diet for 3 days	95.23	4.28	95.50

The results of these tests and a further study of the ether extract of feces leads the author to the conclusion that Palmin is as digestible as other sorts of fat used as food, and that this material, as well as butter and margarin, may be said to be completely digested.

The relative digestibility by man of several sorts of fat. III, Butter and margarin, H. LÜHRIG (*Ztschr. Untersuch. Nahr. u. Genussmtl., 2 (1899), No. 10, pp. 769–783*).—In continuation of the author's previous work (see above), 4 experiments are reported, each of 3 days duration. In the first, 121.67 gm. of margarin was consumed daily with a simple mixed diet. In the second and third, 122 and 143 gm., respectively, of butter was consumed; while in the fourth experiment, which served as a check, no fat was eaten except the very small amount contained in the bread, beans, etc., making up the diet. The average results of the experiments follow:

Digestibility of butter and margarin.

	Fat.		
	In daily food.	In daily feces.	Digested.
	Grams.	*Grams.*	*Per cent.*
Margarin eaten with simple mixed diet	111.62	3.63	96.75
Butter No. 1, eaten with simple mixed diet	107.53	3.37	96.86
Butter No. 2, eaten with simple mixed diet	125.29	3.55	97.16
Mixed diet without the addition of fat	2.64	2.37	90.47

From a study of the chemical characteristics of the undigested fat the author introduces certain corrections in the above values and concludes that 97.86 per cent of the butter was actually digested and 97.55 per cent of the margarin. From a physiological standpoint the 2 fats are thought to be completely digestible and of equal value.

On some comparative analyses of and digestion experiments with wheat and whole-meal breads, O. Rosenheim and P. Schidrowitz (*Analyst, 24 (1899), Sept., pp. 227-231*).—The authors report the composition of ordinary white bread, ordinary whole-wheat bread, and a patent whole-wheat bread. In addition to the usual statistics, the analyses include phosphoric acid, soluble matter, the different constituents of the carbohydrate group, acidity, and in 2 cases the loss of water in 15 days.

Artificial digestion experiments with the 3 sorts of bread were made. These include salivary digestion, gastric followed by pancreatic digestion, and pancreatic digestion. The principal conclusions follow:

> "Although we do not desire to draw any sweeping conclusions from the experiments, owing to their limited number and somewhat restricted character, we feel justified in saying that they tend to bear out the opinion now generally held in scientific circles as to the great superiority of white bread as far as digestibility pure and simple goes. It is usually believed that whole-meal bread contains considerably more nitrogen than the white article, but this was certainly not the case in the breads examined by us; and although they were selected with care, there is sufficient variation in ordinary flours to account for this apparent anomaly. The whole-meal breads certainly contained considerably more ash, phosphoric acid, and soluble matter. The results obtained with the patent brown bread, in which the grain and husk are very finely comminuted, supports the contention that the digestibility and wholesomeness of whole-meal bread can be greatly improved by careful and thorough grinding and disintegration of the cellulose."

The estimation of cellulose in feces, K. Mann (*Arch. Hyg., 36 (1899), No. 2, pp. 158-165*).—The author reports experiments in which he himself was the subject. In the first period the food consisted of wheat bread, cheese, sausage, butter, and sugar. The total cellulose consumed per day was 1.1774 gm. In the second period the sausage and cheese were replaced by 72 gm. of elastin. When the cellulose in the feces was estimated by the Weende method, more was recovered than was consumed. The so-called cellulose was found to contain nitrogen and the material was studied at some length. The author concludes that in the presence of certain nitrogenous materials it is not possible to determine accurately the cellulose in feces by the Weende method. Elastin and other nitrogenous materials are not completely removed and in part account for the high values obtained. In addition to true proteids there are other materials containing less nitrogen and also nitrogen-free substances which are not removed from the feces by the Weende method. Assuming that the nitrogen found was all nitrogen of protein and that the remainder of the material consisted of cellulose, half the cellulose of fine wheat bread was found in the author's experiments to be dissolved in the intestinal tract.

Composition of lucern as affected by maturity, R. HARCOURT (*Ontario Agr. Col. and Expt. Farm Rpt. 1898, pp. 23-29*).—This investigation includes a study of the yield, composition, and digestibility of different crops and cuttings of alfalfa. The total dry matter and the percentage composition of different crops and cuttings are shown in the following table:

Composition of different crops and cuttings of alfalfa.

	Total dry matter.	Protein.	Crude fiber.
Second crop, 1897:	*Pounds.*	*Per cent.*	*Per cent.*
First cutting	3,197	20.12	28.47
Second cutting	3,819	15.54	31.57
Third cutting	3,318	13.79	40.46
First crop, 1898			
First cutting	3,045	20.45	29.98
Second cutting	4,251	14.72	33.16
Third cutting	3,894	13.59	36.75
Second crop, 1898			
First cutting	1,899	16.77	26.10
Second cutting	2,505	16.32	31.46
Third cutting	2,214	14.30	35.81

The digestion experiments were made with sheep, with the following results:

Average digestibility by sheep of different crops and cuttings of alfalfa.

	Dry matter.	Protein.	Fat.	Nitrogen-free extract.	Crude fiber.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
First cutting	58.6	73.4	48.8	71.8	39.1
Second cutting	56.2	72.8	50.4	70.1	37.7
Third cutting	51.3	64.4	44.1	64.0	37.1

The author compares alfalfa with red clover and timothy hay. From the different tests the following conclusions were drawn:

> "Alfalfa deteriorates very rapidly both in percentage composition and in digestibility after the early blossoming stage. In our experimental work a much larger amount of digestible matter was obtained by cutting when the plants were about

one-third in blossom than by cutting either 2 weeks earlier or 2 weeks later. Alfalfa, cut when about one-third in bloom, compares very favorably in nutritive value with red clover and timothy. There appears to be danger in feeding alfalfa hay that has been made from the plant in advanced stages of maturity.

"Notwithstanding the rapidity with which alfalfa deteriorates after passing the early blossoming stage, the fact that when properly saved it yields a large amount of nutritious food makes it a most desirable addition to our list of fodders. In this report of the work done on alfalfa, no attempt has been made to treat of its value as a pasture crop or as a green fodder crop. Complaint has been made that cattle pastured on it show a tendency to bloat. Information is being gathered on this and other points, and a bulletin will be issued at an early date dealing with the whole question of alfalfa."

Alfalfa, or lucern, L. FOSTER and L. A. MERRILL (*Utah Sta. Bul. 61, pp. 155–214*).—The comparative yield, composition, digestibility, and feeding value of different crops and cuttings of alfalfa are reported upon. Tables are given which show the composition of different crops and cuttings of alfalfa from 1896 to 1898, and considerable material of this subject is quoted from a previous publication (E. S. R., 10, p. 977). The authors summarize the deductions regarding the composition of different crops and cuttings and similar topics as follows:

"The largest annual yield of hay per acre is obtained by the method of early cutting and the lowest by the late, the average result standing as follows: Early cutting 100, medium 92, and late 85.

"The early cut alfalfa contains the highest percentage of protein and fat, the most valuable food constituents, and the lowest percentage of crude fiber, the most indigestible portion. The former decrease constantly while the latter increases rapidly from early bloom to the full maturity of the plant.

"The proportionate amount of leaves to stems is greater at early bloom than at any subsequent time and both leaves and stems contain a greater percentage of protein and a less percentage of crude fiber at this time than at any later period in the growth of the plant. The relative proportion of leaves to stems in the different cuttings is as follows: Early 42 to 58, medium 40 to 60, late 33 to 67. . . .

"The first crop gave the largest yield in each of the 5 tests and in 14 out of the 15 cuttings, while the third crop gave the lowest for every test and in every cutting but one. . . .

"In the average composition of all cuttings for 3 years, the nutrients of the 3 crops vary but little. The second has slightly the highest percentage of protein and fiber; and the third the most fat and nitrogen-free extract.

"The third crop has the largest proportion of leaves to stems; but the percentage of protein in the leaves is highest in the second crop, and next highest in the first. The leaves of the first crop contain the most fat and of the second the least."

Feeding experiments (pp. 175–214).—Two feeding tests with steers are reported on the value of alfalfa of different crops and cuttings and comparing alfalfa with timothy hay, shredded corn fodder, red clover, and a mixture of alfalfa and straw. In each experiment these coarse fodders were each fed continuously to one lot of steers. The first test was made during the winter of 1897–98 with 36 two-year old steers divided into 12 lots of 3 each. It lasted 111 days, during a part of which time grain was fed with the coarse fodder.

The second test was made during the winter of 1898–99 with 27 two-year-old steers. The experiment lasted 112 days, grain being fed with the coarse fodder the entire time.

The results are tabulated for each experiment and are discussed at some detail, together with the results of 5 years' experiments at the station. The following is a summary of the deductions drawn from the 2 present experiments:

> "In the feeding tests, the highest gains were made from the early cuttings and the lowest from the late, the results standing proportionately as follows: Early cutting, 100; medium, 85; and late, 75.
>
> "The variation in the amount of the different cuttings eaten per day was very slight, being the highest for the early cutting and the lowest for the late, but the quantity of dry matter and also of digestible matter required for a pound of gain was decidedly lowest for the early cutting and highest for the late, the relative amounts of dry matter standing as follows: Early cutting, 100; medium, 131; and late, 66.
>
> "The annual beef product per acre was largest from the early cuttings, not only in the general average but in each separate season's test, and that from the late cuttings was smallest, the proportional products standing as follows: Early cutting, 100; medium, 79½; and late, 69½.
>
> "Taking all points of comparison into consideration, both separately and collectively, including everything that pertains to the largest yield and highest feeding value, the tests favor cutting alfalfa for cattle feeding when the first blooms appear . . .
>
> "The beef product per acre, taking the average result of all cuttings for the 5 years, was very much the highest for the first crop and decidedly the lowest for the third, standing as follows: First crop, 100; second, 61; and third, 45; but taking the early cuttings alone they stand, first crop, 100; second, 80; and third, 69.
>
> "Pound per pound, taken as a whole, the results show the highest feeding value for the third crop and the lowest for the second.
>
> "The average annual beef product from early cut alfalfa was 705.61 lbs. per acre; it required 9,575 lbs. of timothy to produce an equal weight; 11,967 lbs. of red clover and 10,083 lbs. of shredded corn fodder."

In calculating the financial results the following prices were used: Alfalfa $4, shredded corn fodder $5, timothy hay $6, bran and shorts $10, chopped wheat $16, and chopped corn $16 per ton. On this basis there was a loss in both cases.

> "If the steers of the first test could have been disposed of at the close of the experiment, the loss would have been very much less. The gains from the after feeding were equal in value to only a little more than half the cost of the food that produced them. The increased grain ration added largely to the expense of feeding during this latter period. Judging from the results of the 2 tests here reported, the margin between the purchase and selling prices has been too small for the past 2 years to warrant feeding with foods, especially grains, at as high prices as those used in estimates herein reported."

Experiments in cattle feeding, G. E. DAY (*Ontario Agr. Col. and Expt. Farm Rpt. 1898, pp. 75–80*).—Two tests on fattening steers are reported.

Different quantities of meal for fattening steers (pp. 75–77).—Nine steers were divided into 3 lots of 3 each. Lot 1 was fed a medium grain ration, consisting of equal parts of ground peas, barley, and oats, the amount fed being increased rapidly until the ration reached, as nearly as possible, 1 lb. of meal per 100 lbs. of live weight. Lot 2 was fed the same ration, the amount fed being increased until ⅔ lb. of grain per 100 lbs. of live weight was fed. At the beginning of the trial lot 3 received ½ lb. of the same grain ration per 100 lbs. of live weight. This amount was increased as seemed advisable until the amount fed was the same as that given lot 2. In addition to the grain, all the steers were fed a mixture of hay and straw during the first part of the trial (later on hay alone), together with 15 lbs. of roots per day. The quantity of roots was later increased to 25 lbs.

The test proper began December 3 and covered 179 days. It was preceded by a preliminary period of 30 days under the same conditions. Before the close of the test, 1 steer in lot 2 and 1 in lot 3 were dropped. The total weight of the 3 steers in lot 1 at the beginning of the test was 3,235 lbs.; of the 2 steers in lot 2, 2,245 lbs.; and of the 2 steers in lot 3, 2,241 lbs. The average gain per steer was 301.66 lbs., 285 lbs., and 297 lbs., respectively. The average amount of meal consumed per day per pound of live weight was 0.81 lb., 0.65 lb, and 0.53 lb., respectively.

The financial statement is based on meal at $13, hay $6, straw $3, and roots $2 per ton. The average cost of a pound of gain was for lot 1, 7.7 cts.; for lot 2, 7.26 cts.; and for lot 3, 6.46 cts.

This test is a duplicate of a previous one (E. S. R., 10, p. 277), and the results of the two are compared:

> "In the case of the light and medium rations, the results of the 2 experiments are somewhat contradictory, since in the first experiment the medium ration proved to be the more economical of the two, while in the second experiment this result has been reversed. But in both experiments the results have been decidedly in favor of the 2 lighter rations as compared with the heavy ration. The results of the 2 experiments, therefore, point to the conclusion that for fattening steers a moderately light meal ration is more profitable than a heavy meal ration, provided, of course, that the coarser fodders are of good quality and palatable."

Corn vs. peas for fattening steers (pp. 77, 78).—The relative value of corn and peas was tested with 2 lots of 3 steers each. Lot 1 was fed a grain ration consisting of equal parts of ground corn, barley, and oats, and lot 2 a ration of equal parts of peas, barley, and oats. The amounts of grain, hay, and roots fed were the same as in lot 2 in the preceding test.

The financial statement is based on meal at $13, hay $6, straw $3, and roots $2 per ton. Lot 1 weighed 3,233 lbs. at the beginning of the trial, December 3. During the 179 days of the test, the average daily gain per steer was 1.75 lbs., and the cost per pound of gain, 6.56 cts. Lot 2 weighed 2,245 lbs. at the beginning of the trial. The average gain per steer was 1.59 lbs., and the cost of a pound of gain, 7.26 cts.

"In this experiment, therefore, corn, barley, and oats gave much better results than peas, barley, and oats." The author believes that the gains are influenced greatly by the individuality of the steers and that the comparison is not altogether satisfactory. "Though the results are decidedly in favor of corn as compared with peas for fattening steers, the experiment will be repeated."

Pasteurized vs. raw skim milk for calves, H. H. DEAN (*Ontario Agr. Col. and Expt. Farm Rpt. 1898, p. 66*).—A test with 4 calves comparing pasteurized and raw skim milk is briefly reported. After a preliminary period of 1 week, the test proper began July 18, 1898, and covered 2 periods of 4 weeks each. The periods were separated by an interval of 1 week. In the first period calves Nos. 1 and 2 were fed pasteurized skim milk and Nos. 3 and 4, raw skim milk. In the second period the conditions were reversed. "In addition to the milk and meal, all the calves were fed some hay and green feed; the amount varied according to appetite." The weights of the calves at the beginning of the test were 536, 352, 298, and 228 lbs., respectively, and the corresponding gains during the whole period were 139, 163, 128, and 134 lbs., respectively.

> "All the calves appeared to thrive equally well whether fed on the pasteurized or on the raw skim milk. . . . It would seem that after calves receive a fair start they will do well on skim milk, meal, green feed, and hay. The gains were good and in this experiment 3 of the 4 calves made the greatest gain on the pasteurized skim milk along with meal and other food. To prevent skim milk souring at the creamery or on the farm, pasteurization is the most practicable method; and all creameries should adopt this plan, in order to return the skim milk in good condition to the farm, and thus preserve valuable food for calves and pigs."

Experiments in sheep feeding, G. E. DAY (*Ontario Agr. Col. and Expt. Farm Rpt. 1898, pp. 81, 82*).—Two tests with sheep are briefly reported. In the first a comparison of alfalfa and red-clover hay for lambs was made. Thirteen lambs were divided into 3 lots; lots 1 and 3 contained 4 lambs each and lot 2, 5. The test covered 74 days. Lot 1 was fed red clover hay, lot 2 first crop alfalfa hay, and lot 3 third crop alfalfa hay. In addition all the lots were fed equal amounts of corn and peas 1:1. The red clover and first crop alfalfa hay had been injured by rain; the third crop alfalfa hay was "in very good condition and was much finer in stock than the first crop."

The financial statement is based on oats at 25 cts. and peas at 48 cts. per bushel and hay at $6 per ton. The lambs in lot 1 made an average weekly gain of 2.1 lbs., consuming 5.14 lbs. of meal and 9.03 lbs. of hay per pound of gain. The cost of a pound of gain was 6.63 cts. The average weekly gain made by the lambs in lot 2 was 2.15 lbs. The meal and hay consumed per pound of gain was 4.93 and 8.43 lbs., respectively; the cost of a pound of gain was 6.32 cts. The lambs in lot 3 made an average weekly gain of 2.31 lbs. and consumed 4.67 lbs. of meal and 8.2 lbs. of grain per pound of gain, the cost of a pound of gain being 6.05 cts.

The principal conclusions follow: "In all groups there was some hay wasted, the waste in the case of the first crop alfalfa being considerably greater than in the other two. . . . So far as the experiment goes it would indicate that the feeding value of alfalfa hay approaches very closely to that of red clover when fed to sheep."

In the second test, which also covered 74 days, corn and peas as a fattening ration were compared on 2 lots of 4 lambs each. Lot 1 was fed peas and oats 1:1 and lot 2 corn and oats 1:1, both lots being given clover hay in addition.

The financial statement is based on peas at 48 cts. and corn at 38 cts. per bushel and hay at $6 per ton. The values for corn and peas include the cost of grinding. The results of the test are shown in the following table:

Results of feeding corn and peas to lambs.

	Meal consumed.	Hay fed.	Average weekly gain.	Meal consumed per pound of gain.	Hay fed per pound of gain.	Cost of food per pound of gain.
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Cents.*
Lot 1 (peas and oats)	456.75	802	2.10	5.11	9.03	6.63
Lot 2 (corn and oats)	456.75	802	2.29	4.72	8.27	5.79

"This experiment gives a marked difference in favor of the corn, both in rate of gain and cost of gain, and at the same price per pound for corn and peas the corn would still have the advantage. Further tests are necessary and preparations are being made for repeating the experiment."

Roots as food for pigs, C. S. PLUMB and H. E. VAN NORMAN (*Indiana Sta. Bul. 79, pp. 53-62*).—In 1898 as high as 24.25 tons of mangel-wurzels per acre were produced at the station at a cost of 85 cts. per ton when harvested. Their feeding value was tested with 12 pigs, 7 of which were pure bred Chester Whites and the remainder Chester White-Poland Chinas. The pigs were weaned only 2 days before the beginning of the test, when they were about 3 months old. They were divided into two uniform lots, each lot containing 3 males and 3 females. The test began February 1 and closed April 19, 1899. The pigs were confined in small lots 15 by 30 ft. in size, with a comfortable shelter house in each lot. Lot 1 was fed a slop consisting of corn meal and shorts, 1:2, and cut mangel-wurzels *ad libitum*, Lot 2 was fed corn meal and shorts only. The pigs were supplied with water, ashes, and salt. Weighings were made at the end of each week. At the beginning of the test the average weight of the pigs in the 2 lots was 44 and 46.1 lbs., respectively. The average daily gains in the 2 lots were 4.61 and 5.74 lbs., respectively. Each lot consumed 3.71 lbs. of meal and shorts per pound of gain. In addition to the grain ration, lot 1 ate 514 lbs. of mangel-wurzels during the test. Rating the corn meal at 80 cts., shorts at 70, and mangel-wurzels at 10 cts. per hundred pounds, the cost of food per pound of gain was 2.8 and 2.7 cts., respectively. The authors compute the amount of digestible nutrients in the rations eaten.

"The mangels were fed only as eaten up clean, and the pigs did not eat them with the relish that might have been anticipated. The cut roots were mixed with the grain slop, and the pigs would clean up the slop in preference to the roots as a general rule, eating the latter quite leisurely. . . . It required exactly the same amount of corn meal and shorts to make a pound of gain with each lot. . . . The total cost of all food for each pound of gain for lot 1 was slightly in excess of the cost for lot 2, the roots making this extra expense, which amounted to 10 cts. for each 100 lbs. of gain in live weight."

The authors continued the experiment from April 19 to June 7 in order to determine whether a succulent ration had any beneficial aftereffects, each lot being fed a ration of corn meal and shorts. The average weight of the pigs in lot 1 at the beginning of this test was 113.3 lbs., and of those in lot 2, 129.1 lbs.; the average daily gains were 8.39 and 8.55 lbs., respectively. The pigs in lot 1 required 4.44 lbs. of grain valued at 2.99 cts. to make a pound of gain; those in lot 2, 4.36 lbs. valued at 2.98 cts.

"If the mangels were of value in the feeding, the figures show it in only a small way. The mangel-fed pigs were no more healthy at any time . . . than were those not so fed, while it has been shown that the cost of producing flesh with them was slightly more than with the others. The difference, however, was so slight, that a redistribution of the pigs, or a substitution of another in lot 1 might have reversed the results. . . .

"The writers feel that roots in some form are a desirable food for pigs in winter, as an addition to the grain ration, in promoting healthy activity of the digestive organs and acting as an appetizer. Sugar beets, artichokes, or carrots would no doubt serve this purpose better than mangels They are more expensive in view of greater cost of production, but this difference is not important. They, however, contain enough more sugar to make them somewhat better relished by the pigs than are the mangels."

Experiments in swine feeding, G. E. DAY (*Ontario Agr. Col. and Expt. Farm Rpt. 1898, pp. 82–91*).—Several experiments with different feeding stuffs and with breeds of pigs are reported.

Experiments with pure-bred swine (pp. 82–86).—This is in continuation of previous work (E. S. R., 10, p. 278.) Thirty-six pigs were divided into 3 lots of 12 each, containing 2 pigs of the following breeds: Yorkshire, Chester White, Tamworth, Duroc Jersey, Poland China, and Berkshire. The pigs were from 7 to 9 weeks old when purchased. From June 14 until the beginning of the experiment proper, July 4, they were fed under conditions similar to those in the experiment proper to accustom them to their changed surroundings and feed. The test covered 112 days. Lots 1 and 2 were confined in pens, the pigs of each breed being kept separate. Each pen opened into a small yard. Lot 3 was given the run of a half-acre lot with shelter. For about a month the pasture furnished some grass and clover. All the pigs were fed the same grain ration. Until August 19 this consisted of wheat middlings; from August 19 until September 12 of equal parts of barley and shorts; and from September 12 until the close of the experiment of equal parts of peas, barley, and shorts. In addition, whey was fed lot 2. In discussing the gains made by the different breeds, lots 1 and 2 were compared. The results are summarized in the following table, the breeds being arranged in the order of economy of gain. No account was taken of the whey, since the amount fed was the same for all breeds.

Results of feeding pure-bred swine.

Breed.	Average weight at beginning of test.	Total gain per pig in 112 days.	Average daily gain per pig.	Meal consumed per pound of gain.
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*
1, **Yorkshire**	52.00	123.75	1.10	3.50
2, **Berkshire**	49.50	120.00	1.07	3.70
3, Duroc Jersey	59.25	120.00	1.07	3.76
4, Tamworth	47.75	119.25	1.06	3.78
4, Chester White	56.00	119.25	1.06	3.78
5, Poland China	68.75	117.75	1.05	3.83

"The uniformity of the gains of the different breeds is rather remarkable. The Yorkshires and Berkshires consumed rather less meal than the other breeds, and this accounts for the considerable difference in the quantities of meal required for 100 lbs. of gain. The Poland Chinas were placed at a slight disadvantage, in that they were heavier than the other breeds "

At the close of the test the pigs were sold and slaughtered, the carcasses being judged by an expert with a view to their value for bacon.

"On the whole the breeds rank pretty much the same as in previous years. It is worthy of note that it did not cost more in this feeding test to produce a pound of gain in the case of a good type of bacon hog than in the case of less suitable types.

"The experiment also indicates that while the bacon type is apparently more common in some breeds than others, yet very good bacon types occur in practically all the breeds tested. The selection of breeding stock, however, to conform to the bacon type, among some of the breeds tested, would mean a divergence from the standards of excellence provided for the direction of breeders."

The feeding value of whey, the influence of exercise on growth, and the amount of meal required per pound of gain at different weights are discussed with the 3 lots.

"In this experiment 100 lbs. of whey proved equal in feeding value to 14 lbs. of meal, showing that whey is valuable food for swine when fed judiciously . . . There is a steady increase in the amount of meal required to produce a pound of gain as the hogs increase in weight, and [this] is a strong argument in favor of marketing hogs by the time or a little before they reach 200 lbs. live weight."

Rape for fattening hogs (pp. 86–91).—Two tests were made of the value of rape for fattening pigs. Further, corn meal was compared with peas, barley, and shorts, 1:1:1, with the same lots with special reference to the effect of these feeding stuffs upon the firmness of bacon. The first test, which covered 42 days, was made with 3 lots of 4 pigs each. Lots 1 and 2 were fed corn meal, lot 1 receiving only two-thirds as much as lot 2. Lot 3 was fed a mixture of equal parts by weight of peas, barley, and shorts. In addition to the grain ration, lot 1 was fed all the rape they would eat up clean. The results of the tests follow:

Results of pig-feeding tests.

	Average weight of pigs at beginning of experiment.	Total gain per pig.	Average daily gain per pig.	Food consumed per pound of gain.	
				Grain.	Rape.
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Lot 1 (corn and rape)	118	61	1.45	2.61	8.48
Lot 2 (corn alone)	107	64	1.52	3.69	....
Lot 3 (peas, barley, and shorts alone)	104	60	1.42	3.93	....

The second test also covered 42 days, and was made with 2 lots of 4 and 1 of 3 pigs. Lots 1 and 3 were fed a mixture of equal parts by weight of peas, barley, and shorts; lot 2 was fed corn meal. The amount of grain fed lot 1 was two-thirds of the amount fed lot 2, but in addition to the grain lot 1 was fed rape. The results of the test follow:

Results of pig-feeding tests.

	Average weight of pigs at beginning of experiment.	Total gain per pig.	Average daily gain per pig.	Food consumed per pound of gain.	
				Grain.	Rape.
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Lot 1 (peas, barley, and shorts with rape)	100	47	1.12	2.79	8.47
Lot 2 (corn alone)	94	46.5	1.10	4.09	
Lot 3 (peas, barley, and shorts alone)	107	51	1.21	3.88	

In the author's opinion, the 2 tests show no great variation due to the different feeding stuffs.

"The most striking feature of the experiment is the marked saving in meal required for 100 lbs. of gain effected by the use of rape. It indicates that rape has a very considerable value as a food for hogs; but, owing to the somewhat contradictory results in connection with its effect on the firmness of bacon, it is hardly safe to recommend it for hog feeding until it has been further tested."

On the basis of all the tests reported, the influence of feeding and exercise on the firmness of bacon is discussed. The conclusions are summarized as follows:

"Corn apparently produces no evil effects upon the firmness of bacon when used for finishing hogs that have plenty of exercise until they reach about 100 lbs. live weight. Neither does corn appear to have any bad effects when used for finishing hogs that have had no exercise, but have been fed skim milk with a mixed grain ration until they reach 100 lbs. live weight.

"What has been said of corn may also apply to rape, when fed with a two-thirds meal ration, though the evidence is somewhat conflicting on this point.

"Hogs confined in pens and fed on wheat middlings during the early stages of growth, and on peas, barley, and shorts during the finishing period, have a marked tendency to softness. Hogs given plenty of exercise, and fed as just described, produce firmer bacon than those confined in pens. The evil effects arising from lack of exercise can be overcome by the judicious use of skim milk and whey. The amount of whey recommended is from 2 to 2½ lbs. of whey to 1 lb. of meal. Whey and skim milk appear to have a greater influence than exercise in producing firm bacon. Unthrifty hogs are more likely to produce soft bacon than growthy, well-fed hogs.

"The points mentioned above are not offered as definite conclusions, for the investigation is only well begun. On the whole, however, there seems to be nothing in the results which might not reasonably be expected—a fact which adds to their value in no slight degree."

Report of manager of poultry department, L. G. Jarvis (*Ontario Agr. Col. and Expt. Farm Rpt. 1898, pp. 193–196*).—The work of the poultry department is briefly reported.

Egg preservation (pp. 193, 194).—In tests with a solution of lime and water glass (sodium silicate) for preserving eggs the best results were obtained with water glass. Satisfactory results were obtained when a solution of 1 part of water glass to 15 parts of water was used, and with 1 part of water glass to 20 parts of water.

Feeding ducks for market (pp. 194, 195).—Seven Pekin and 9 Rouen ducks were fed from the time they were hatched until 10 weeks old. The first 2 weeks they were given a ration consisting of equal parts of corn meal, wheat bran, and middlings mixed to a thick mush with hot water. They were fed 5 times a day all they would eat up clean. During the remainder of the test the ration consisted of wheat bran and middlings, 2:5. This was also fed in the form of a mush. All the ducks were given grit and sharp sand. No water, except for drinking purposes, was supplied them.

When 6 weeks old, the 7 Pekin ducks weighed 39 lbs., and the 9 Rouen ducks, 36 lbs. At the close of the test, or when 10 weeks old, the Pekin ducks weighed 59½ lbs., and the Rouen ducks, 63 lbs.

"By selecting the right varieties of ducks, and feeding them on the right kinds of food, you can get them on the market when 6 weeks old. We also find that water is not needed, except for drinking purposes, but is a hindrance to the growth and fattening of ducks.

"We selected two of the best varieties of ducks for market purposes; and while they have the same standard weight, when fully matured, the experiment plainly shows that the Pekins can be made to take on flesh faster than the Rouens. No ducks should be kept longer than 10 weeks, as they can be placed on the market at that age and sold at a good profit.

"Ducks that are intended for breeding purposes should not be fed on a fattening ration, so as to weaken them by too much forcing. They should be selected when about 6 or 7 weeks old, when their sex can readily be seen and the most perfect specimen selected."

Tests on fertility and egg production (pp. 195,196).—Several tests were made on the production and fertility of eggs. Ten laying hens were separated from the male. The eggs laid each day were placed in an incubator and their fertility tested. Of the eggs laid during the first 4 days after the male was removed 70 per cent were fertile; of those laid on the fifth day, 61 per cent; on the sixth, 60 per cent; on the seventh, 49 per cent; on the eighth, 12 per cent; on the ninth, 2 per cent; and on the tenth, all were infertile.

A test was also made with 6 laying hens to determine the time which must elapse before eggs become fertile after a male is introduced. On the third day, 30 per cent of the eggs were found to be fertile; on the fourth, 42 per cent; on the fifth, 50 per cent; on the sixth, 60 per cent; on the seventh, 70 per cent; on the eighth, 68 per cent; on the ninth, 70 per cent; on the tenth, 74 per cent.

The influence of the male on the total number of eggs produced was also tested with 2 lots. Lot 1 consisted of 5 pullets, 5 hens, and 1 cock; lot 2, of 5 hens and 5 pullets of the same varieties as lot 1. The test began January 1 and lasted until September 1. Both pens were fed and cared for in the same way. Lot 1 laid 959 eggs and lot 2, 972 eggs. "It can be seen that there was but very little difference in the number of eggs laid by the 2 pens."

Brief statements are also made concerning the different cross breeds of chickens raised at the station.

Dietetic preparations of recent origin, H. Bremer and L. Geret (*Ztschr. Untersuch. Nahr. u. Genussmtl., 2 (1899), No. 10, pp. 791-793*).—A summary is given of this paper which was presented at the 71st meeting of the German Naturalists and Physicians at Munich, September, 1899.

Concerning meat extract, H. Bremer (*Ztschr. Untersuch. Nahr. u. Genussmtl., 2 (1899), No. 10, pp. 793, 794*).—A summary of a paper presented at the 71st meeting of the German Naturalists and Physicians at Munich, September, 1899.

The nutritive value of beef prepared in the ordinary ways, G. Lebbin (*Aerztl. Sachverständ. Ztg., 4 (1898), pp. 437-440; abs. in Ztschr. Untersuch. Nahr. u. Genussmtl., 2 (1899), No. 7, pp. 575, 576*).—This article is evidently a résumé of an investigation by K. Förster, previously noted (E. S. R., 10, p. 662).

The comparative dietetic value of wheat and whole wheat bread (*Lancet [London], 1899, No. 3971, p. 852*).—A brief general discussion.

Cotton-seed oil as food (*Lancet [London], 1899, No. 3961, pp. 294, 295*).—A brief note on the subject.

A contribution to the study of caseon, M. Wintgen (*Ztschr. Untersuch. Nahr. u. Genussmtl., 2 (1899), No. 10, pp. 761-769*).—The composition, properties, and digestibility of caseon, a proteid preparation made from skim milk, are reported upon. The digestion experiments were made with 2 men, caseon being eaten with rice, wheat bread, butter, and sugar.

Condensed milk, T Macfarlane and A. McGill (*Lab. Inland Rev. Dept. Ottawa, Canada, Bul. 51, pp. 28*).—The authors report the analysis of 66 samples of condensed milk. The bulletin also contains a section on analytical methods.

Report of the analyst, A. E. Leach (*Massachusetts State Bd. Health Rpt. 1898, pp. 695-719*).—In addition to statutes regarding the purity of foods, drugs, etc., examined, the composition of a number of samples of condensed milk is reported.

Infants' and invalids' foods, T. Macfarlane and A. McGill (*Lab. Inland Rev. Dept. Ottawa, Canada, Bul. 59, pp. 24*).—Analyses of a large number of samples of commercial foods for infants, children, and invalids are reported. The analytical methods followed are described. The different classes of these foods and their food value are discussed.

Contribution to the study of ropy bread, A. Juckenack (*Ztschr. Untersuch. Nahr. u. Genussmtl., 2 (1899), No. 10, pp. 786-788*).—A summary of a paper presented at the 71st meeting of the German Naturalists and Physicians at Munich, September, 1899.

The behavior of elastin in the metabolism of man, K. Mann (*Arch. Hyg., 36 (1899), No. 2, pp. 166-177*).—Experiments on the value of elastin in which the balance of income and outgo of nitrogen was determined are reported. The author was himself the subject.

How far is alcohol a protector of protein, T. R. Offer (*Chem. Ztg., 23 (1899), No. 79, p. 833*).—A brief note of the author's paper presented before the Section of Physiology at the September meeting of the Society of German Naturalists and Physicians in Munich. Basing his deductions on metabolism experiments in which he was himself the subject, the author concludes that alcohol actually protects protein, though its value for this purpose is not great.

The examination of food preparations, C. Posner (*Berlin. Klin. Wchnschr., 35 (1898), pp. 654-661*).

The identification of the chaff occurring in foods and feeding stuffs, J. Formánek (*Ztschr. Untersuch. Nahr. u. Genussmtl., 2 (1899), No. 11, pp. 833-842, figs. 9*).

On the occurrence of phytosterin in the animal body after ingestion of cotton-seed meal, C. Virchow (*Ztschr. Untersuch. Nahr. u. Genussmtl., 2 (1899), No. 7, pp. 559-575*).—A number of experiments with dogs and pigs are reported. According to the author his investigations substantiate A. Bömer's conclusion that phytosterin can not be taken up into the fatty tissue of animals.

Live stock, W. Rennie (*Ontario Agr. Col. and Expt. Farm Rpt. 1898, pp. 188-192*).—Statistics are given of the steers, milch cows, sheep, pigs, and horses kept at the farm. The steers were fed a mixed ration consisting of chopped grain and bran with cut corn fodder, chaff, pulped roots, silage, turnips, etc. The rations were varied somewhat each month and at no one time were all the materials fed.

Fifteen steers at the beginning of the trial weighed 13,333 lbs., and in 6 months made an average monthly gain of 291$\frac{7}{15}$ lbs.

Horse breeding, M. Fischer (*Fühling's Landw. Ztg., 48 (1899), No. 21, pp. 798–809, figs. 5*).—A general article.

The economic feeding of working horses, T. U. Walton (*Rpt. Australian Assoc. Adv. Sci. 1898, pp. 953–955*).—Abstracted from another publication (E. S. R., 11, p. 74).

Geese and geese breeding, E. Brown (*Jour. Roy. Agr. Soc. England, 3. ser., 10 (1899), pt. 2, pp. 313–351*).—The author discusses at length the uses, varieties, feeding, and killing and dressing of geese and the geese-breeding industry. Numerous references to the literature of the subject are made.

DAIRY FARMING—DAIRYING.

Testing cows at the farm, E. H. Farrington (*Wisconsin Sta. Bul. 75, pp. 30, pls. 8, fig. 1*).—A detailed account is given of farm tests extending through 1 year of 6 dairy herds supplying milk to the university creamery.

The milk of each cow was weighed and sampled by the patron at the morning and night's milking one day in each week, and the samples were tested at the creamery. The mixed milk from each farm was also weighed and tested when received at the creamery, and a comparison made of the farm and creamery weights and tests, to determine the accuracy of the farm records. "The results show that tests of dairy cows can be made by the farmers themselves with sufficient accuracy to give a very satisfactory knowledge of the performance of each cow."

The complete details of the weekly tests of one cow are given to illustrate the method employed in calculating the total milk and fat production. Notes are given on the feeding of the cows at the different farms, which was according to the usual practice of the owner. The cost of feed for one herd of 12 cows, as estimated by the owner, was $355, and the receipts from the milk at the creamery, calves, and skim milk amounted to $698, making an excess of receipts above cost of feed of $28 per cow. Tables show the annual production and creamery value of the milk of each of 33 cows, representing 4 herds, tested through one period of lactation.

The extreme variation in the butter value of the cows on 4 of the farms is shown in the following table:

Range in value of annual products.

	Farm A.	Farm B.	Farm C.	Farm D.
Best cow	$53.35	$58.20	$60.72	$55.49
Poorest cow	$28.72	$44.83	$37.96	$39.60
Average cow	$36.30	$50.00	$48.83	$44.12
Number of cows in the herd	12	5	12	4

The differences in profit from the poorest and the best cows are pointed out. Illustrations from photographs are given of 14 different cows, which were in the above tests, together with their records.

In discussing the most profitable month for fresh cows a table is given showing the average prices received per pound of fat for the total production of cows fresh in the different months, from which it appears that the highest price was received for cows fresh in September and the lowest for cows fresh in December.

Semimonthly tests of one day each are considered satisfactory in determining the total production of a cow. In this connection work published by the author in Bulletin 24 of the Illinois Station (E. S. R., 4, p. 944) is summarized.

Milking cows twice and three times per day, H. H. DEAN (*Ontario Agr. Col. and Expt. Farm Rpt. 1898, p. 65*).—Two cows were milked 3 times per day for 2 weeks, and after an intervening period of 1 week, were milked twice per day for 2 weeks. The rations were changed during the intervening period. A table shows the amounts of food consumed and the milk and butter produced. When milked twice per day, one cow gave 13 lbs. of milk less and 0.39 lb. of fat more, and the other cow 5 lbs. of milk and 1.35 lbs. of fat less in the 2 weeks than when milked 3 times per day.

"In the case of these 2 cows, one of which produced an average of 52 lbs. of milk per day, and the other about 12 lbs. per day, it did not pay to milk them 3 times a day. With cows producing 60 lbs. of milk or over per day it will likely be profitable to milk them 3 times a day."

On the formation of fat in the animal organism by intensive feeding of fat, V. HENRIQUES and C. HANSEN (*41 Ber. K. Vet. Landbohöjskoles Lab. Landökon. Forsög* [*Copenhagen*], *1899, pp. 40, col. charts 3*).—The author studied the question of the formation of fat in the body of pigs and in the milk glands of cows by heavy feeding of fat.

Experiments with pigs.—In the experiments with pigs, 2 three-months-old pigs were fed for a period of 168 days on rations consisting of ground barley and varying amounts of cocoanut oil or linseed oil. The oil was mixed with the ground barley (in case of cocoanut oil, after it had been melted), and the mixture made into a slop with water. The changes in the chemical composition of the body fat of the animals were studied by removing at different periods a portion (5 to 10 gm.) of the fatty tissue underlying the skin on the backs of the animals. A cocain solution was injected prior to the operation and the wound properly dressed afterwards. The fatty tissue was warmed to 100° C. in a current of carbon dioxid, pressed through a piece of muslin, and the liquid fat cleared by filtering through filter paper. The fat was examined for iodin number, index of refraction, and for drying oils.

The feed of the pigs during 5 periods of the experiment, in which the fat of the food was gradually increased, with results of the examinations of the body fat of each pig at 4 different dates and at slaughtering time, are given in the following table:

Feed given and results of fat examinations.

Period.	Feed per day.				Date of sampling.	Examination of body fat.			
	Pig 1.		Pig 2.			Pig 1.		Pig 2.	
	Oil.	Barley.	Oil.	Barley.		Iodin number	Refraction.	Iodin number	Refraction.
	Gm	*Gm.*	*Gm.*	*Gm.*					
Oct. 1-15	*a* 125	725	*b* 125	1, 000	Oct. 10	70. 3	60. 5	70. 9	60. 8
Oct. 16–Nov. 15	*a* 200	1, 225	*b* 200	1, 500	Dec. 12	57. 5	56. 9	109. 2	66. 7
Nov. 16–Dec 9	*a* 250	1, 725	*b* 250	2, 000	Dec. 30	71. 8	60. 6	88. 3	64. 2
Dec 10–Feb 2	*b* 300	2, 000	*a* 300	2 225	Feb. 1	92. 8	64 2	83. 8	62. 2
Feb. 3–Mar. 17	*b* 400	2, 225	*a* 400	2, 500	Mar. 17	100. 3	65. 4	69. 7	59. 8

a Cocoanut oil. *b* Linseed oil

The data furnish proof of the presence of the linseed oil in the newly-formed fat of the body of the pigs. As the iodin number of pure olein is 86.2, there must have been found large quantities of glycerids of the linoleic acid series in the fat at the time of the heavy linseed oil feeding, the iodin number of linoleic and linolenic acids being 181.4 and 274, respectively, while that of the linseed oil fed was 177.2, and that of cocoanut oil 8.1. The oxy-acid of linoleic acid, sativic acid, was also found present in large quantities in the fatty tissue of the pigs obtained at slaughtering time.

Experiments with cows.—The experiments were suggested largely by Soxhlet's recent trials with feeding fat in emulsion to milch cows (E. S. R., 8, p. 1016). Two cows were fed a basal ration of hay and extracted linseed meal (containing 0.3 per cent of fat), to which linseed oil in varying quantities was added. Cow 1 received 12 kg. of hay, 0.75 kg. of linseed meal, and 0.5 kg. of linseed oil in emulsion per day. Cow 2 received 8 kg. of hay, 1.25 kg. of ground barley, 0.75 kg. of linseed meal, and amounts of linseed oil ranging from 0.5 to 1 kg. per day. When the quantity of oil was increased to 1 kg the cow lost her appetite and soon had tympanitis. The experiment lasted from June 6 to July 23 for cow 1, and from October 25 to April 12 for cow 2. The milk yield of the cows, and the composition of the milk and butter, were determined during the progress of the experiment, the iodin number, refraction, volatile acids, and melting point of the butter being ascertained.

The results obtained show that the percentage of fat in the cows' milk as a rule increased during the first 4 to 6 days of oil feeding, in single cases nearly 1 per cent; after 10 to 15 days, however, the fat content again became normal, in spite of the fact that the oil emulsion feeding was continued. The yield of milk and of fat changed with the oil feeding in the same manner as the percentage of fat in the milk.

The examinations of the butter fat showed that the volatile fatty acids decreased greatly during the linseed-oil feeding (lowest Reichert number obtained for cow 1 being 16.5 and for cow 2, 12.5, for 5 gm. of fat). This effect of the oil feeding was much more persistent than on either the yield or fat content of the milk, and on discontinuance of the oil feeding the return to a normal volatile acid content came but slowly. The iodin number rose and fell rapidly with the feeding of oil and discontinuance of it. The maximum number obtained was 70.4 (cow 2). As only small quantities of linoleic acid were found in the fat (see below), the increased iodin number must have been due to an increase in the olein content of the fat on oil feeding. The index of refraction changed in the same manner as the iodin number, the curves for the two sets of determinations following each other closely throughout the experiments. The increase due to the oil feeding was very marked and rapid, with the maximum appearing about the fifth day of the oil feeding. The melting point of the fat increased in the same manner as the iodin number, viz, from 35.4 (normal ration) to 39° C. (0.5 kg. linseed oil).

The amount of sativic acid in 50 gm. of butter fat (determined by Hazura's method) in the different periods was (for cow 2) as follows: Trace, 0.012, 0.013, and 0.037 gm. A mixture of butter fat containing 15 per cent of linseed oil gave by the same method 0.842 gm. of sativic acid.

A direct transfer of food fat to milk fat is therefore of small importance. Soxhlet's theory that the food fat is deposited in the body, and the body fat changed into milk fat is shown to be wrong by the results of the Hübl test, since the iodin number of beef fat is 40, while that of the butter fat on the oil feeding was about 58. By partially starving a milch cow the volatile acids in the fat were not appreciably changed, while a marked increase was found in the iodin number and a decrease in the melting point. It seems probable, therefore, in the opinion of the authors, that during inanition the fatty body tissue is deprived especially of the liquid compounds (olein), which pass over into the milk fat.

The general conclusion is drawn that when a large quantity of fat is supplied to the animal organism in the food it will, after having been transferred to the blood, be secreted as milk fat, but the secretion can not be looked upon as a direct transmission of the fat from the blood to the milk glands. The fat added will be worked over in passing through the alveoli cells of the milk gland in such a manner that a large amount of olein and a small amount of a fat having a high melting point (stearin?) are formed. If there are large quantities of drying oils in the fat consumed, these will be changed to nondrying oils before being secreted in the milk.—F. W. WOLL.

Effect of drought on the quality of milk, A. W. STOKES (*Dairy, 31 (1899), No. 130, pp. 292, 293*).—In the inspection of milk furnished by farmers to wholesale dealers in London a number of samples were found having over 13 per cent total solids and less than 8.5 per cent solids-not-fat. To determine the cause of these abnormal milks the author visited one of the farmers and took samples of the milk from his herd of 35 cows. Three samples were from individual cows and 10 were composite samples representing 2 to 5 cows each. Of the 13 samples only 2 were above 8.5 per cent solids not fat. The mixed milk of the herd contained 12.6 per cent total solids and 7.85 per cent solids not fat. The production of this abnormal milk is considered as influenced by the prolonged heat of the summer, the extra work involved in securing sufficient food from the dried-up pastures, and the unlimited water supply accessible to the cows.

Of 3,641 samples analyzed during July, August, and September, 1898, 196 were found to contain over 12 per cent total solids and less than 8.5 per cent solids not-fat. Similar results were obtained during the corresponding months in 1899. During prolonged dry seasons the author urges caution in condemning milk as watered which has 12 per cent total solids.

The pathology of milk, G. L. EASTES (*British Med. Jour., 1899, No. 2028, pp. 1311, 1312*).—The author records the results of microscopical and bacteriological examinations of 186 samples of milk "obtained from all parts of the [British] kingdom from medical officers of health, public institutions, and from private sources." While the primary object was to detect any tubercle bacilli present, the samples were also examined for other micro-organisms, the character of cells present, and the presence or absence of pus. It is stated that normal milk always contains leucocytes. When they are marked the milk should first be examined for colostrum corpuscles, and where these are absent the leucocytes are frequently associated with so-called mucous threads.

> "In hardly any case are these mucous threads present unaccompanied by pus cells, and the presence of such threads may usually be taken as corroborative proof that the leucocytosis is due to some inflammatory lesion. . . . The presence of an excess of leucocytes and this mucin-like substance constitutes 'muco' pus, and is a sign of the existence of an inflammatory lesion of the ducts of the udder, for it is in such lesions that the mucous material is excreted, and not from abscess cavities in the substance of the gland."

When an excess of leucocytes is found unaccompanied by this mucin-like material, which was the case in quite a number of samples, the nature of the leucocytosis is indicated by the presence of streptococci. When pus is present chains of cocci are found in the stained deposit, often in very large numbers, and frequently closely associated with the individual pus cells. Streptococci were found in nearly every sample of milk containing pus, while they were rarely found in milk not so contaminated. A streptococcus is known to be a cause of the infectious disease of the udder known as bovine mastitis, and the author cites a case of poisoning in human beings in which streptococci were the only pathogenic micro organisms found in the milk. He has "not the slightest doubt that unboiled milk containing streptococci is also responsible for some of the cases of infantile diarrhea and mortality."

The presence of blood is said to usually indicate the existence of an active inflammatory lesion, but not always, as it may be present in very early lactation due to physical causes.

The results of the study are summarized as follows:

> "Of 186 milks examined, tubercle bacilli were present in 11, and doubtfully in 2 others. One was doubtful because only one bacillus, morphologically correct, was found; the other because though of the right color, the beading was not apparent in any except one, and in that only imperfectly. In 47 there was pus, and muco pus was present in another 77. Both of these objectionable features were absent in 51 cases, and the question was undecided in the other 11. Blood was noted in 24 samples, absent in 77, and probably absent in 85. Streptococci were found in 106 cases, absent in 53, and undetermined in 27. Colostrum corpuscles were detected in 16 specimens. The percentages in the mixed milks work out as follows: 5.3 per cent contained tubercle bacilli; 30 per cent contained pus, and 48.7 per cent muco pus, these varieties being therefore present in 78.7 per cent of all mixed milks examined. They were absent in only 15 per cent and doubtful in the other 6.3 per cent. Streptococci were found in 75.2 per cent of the samples, absent in 15 per cent, and doubtful in the remaining 9.8 per cent.
>
> "Milk which contains pus or muco pus and streptococci is unfit for human consumption, but, unfortunately, according to my figures, this would entail condemning 80 per cent of the samples I have examined. . . . Should such milks also contain tubercle bacilli they should be unhesitatingly condemned as unfit for consumption in any form, for example, as butter, cheese, etc."

The virulence of the milk of cows which reacted with tuberculin but showed no clinical evidence of tuberculosis, OSTERTAG (*Ztschr. Fleisch. u. Milchhyg., 9 (1899), No. 9, pp. 168, 169*).—The investigation was made on a herd of 50 cows which was to be treated by the Bang method. The milk was examined for tubercle bacilli by bacteriological methods, intraperitoneal inoculation of the cream sediment according to Obermüller, and feeding the same to guinea pigs. It was found in the first series of experiments that the milk of 49 of the cows contained no tubercle bacilli. In the second series one of the inoculated animals was found when killed to be tuberculous, but a repetition with the same milk failed to produce any signs of tuberculosis. From this the author infers that the milk of cows which react may occasionally contain tubercle bacilli without necessarily being capable of communicating the disease through feeding. From his own experiments and those of others the author concludes that the milk of cows which react with tuberculin but show no clinical evidence of tuberculosis, can be regarded as uninjurious.

Contribution on the question of the infectiousness of the milk of tuberculous cows and the value of tuberculin inoculation, LYDIA RABINOWITSCH and W. KEMPNER (*Ztschr. Hyg. u. Infectionskrank., 31 (1899), No. 1, pp. 137-152*).—The authors review and summarize the literature to show that the milk of tuberculous cows has been found by inoculation experiments to be infectious in from 6 to 55 per cent of the cases, the greatest infectiousness being in cases of milk of cows which were either in advanced stages of generalized tuberculosis or had tuberculosis of the udder.

They studied the virulence of the milk of 15 cows which reacted with tuberculin. In the case of 10 cows the sediment of the cream when injected into guinea pigs produced symptoms of tuberculosis. Only one of the cows exhibited any clinical evidence of udder tuberculosis, and two others showed no evidence of any form of the disease.

The authors conclude that in the early stages of tuberculosis, in which no disease of the udder is apparent, as well as in the latent tuberculosis, which can only be detected by the tuberculin test, the milk may contain tubercle bacilli and is to be regared as suspicious. These results, the authors urge, indicate the diagnostic value of tuberculin, and lead them to pronounce it "the most important factor in the production of tubercle free milk."

In a review of the above paper, Ostertag (*Ztschr. Fleisch u. Milchhyg.*, *9* (*1899*), *No. 10*, *p. 192*) claims that the sweeping conclusions as to the danger from tuberculosis are not warranted. He points out that several of the cows used were in advanced stages of the disease, and that under the circumstances the air of the stable would contain large numbers of bacilli which might gain access to the milk from that source during milking. He objects also that no experiments were made in which the milk was fed to animals, that the turberculin test had been made 3 months previous to the examination of the milk, and that the clinical examination of the animals was not sufficiently thorough.

Remarks on Ostertag's paper on the virulence of milk of cows reacting with tuberculin, etc., and a reply to his criticisms, LYDIA RABINOWITSCH and W. KEMPNER (*Centbl. Bakt. u. Par.*, *1. Abt.*, *26* (*1899*), *No. 10*, *pp. 289–292*).—In this controversial article, the authors point out that the material fed by Ostertag, the skim milk, was not nearly as infectious as the cream, which usually contains a large proportion of the tubercle bacilli. They interpret some of Ostertag's results differently from what he did, and claim that the results of the first series of experiments are disputed by those of his second series. They hold, therefore, that his results are not opposed to theirs obtained on two occasions, namely, that in cases of latent tuberculosis, in which the tuberculin reaction is the only indication of the disease, the milk may contain tubercle bacilli.

In conclusion they reply to some criticisms of their previous paper by Ostertag.

On the Reichert figure of butter, J. H. STEBBINS, Jr. (*Jour. Amer. Chem. Soc.*, *21* (*1899*), *No. 10*, *pp. 938–940*).—The Reichert number is given for 317 samples of butter representing that exported to South American ports by 5 firms during the years 1897, 1898, and 1899. "The average of these 317 tests is 14.7. The highest figure obtained was 18.2, and the lowest figures found were 11.2, 11.4, and 11.7." The 3 samples showing the lowest numbers were all of winter butter, "the one giving the figure 11.2 having been kept so long that it was on the verge of becoming tallowy, while the other two were decidedly rancid."

The opinions of a number of chemists are cited as to the minimum Reichert number allowable, showing a considerable difference of opinion. The author favors placing the limit at 11.5, believing that it would not be prudent to go much below this, so as to cover such extreme cases as cited.

Examination of skim milk and buttermilk in Swedish creameries, N. ENGSTRÖM (*Meddel. K. Landtbr. Styr., 1898, No. 8, pp. 45–48*).—The skim milk and buttermilk in the creameries participating in the Swedish butter exhibitions were sampled and analyzed in the spring and the fall of 1898, 5-day composite samples being taken in all cases. The number of samples examined, styles of machines, and average fat content of the samples are shown below:

Examination of skim milk in Swedish creameries, 1898.

Styles of machines.	Pasteurized.			Not pasteurized.		
	No. of samples.	Av. fat content.	Milk separated per hour.	No. of samples.	Av. fat content.	Milk separated per hour.
		Per cent	*Pounds.*		*Per cent.*	*Pounds.*
Alpha AII, 1894	171	0.11	1,600	60	0.19	1,620
Alpha AI, 1894	187	.11	1,060	102	.15	1,070
Alpha AII, old model	36	.11	1,310	10	.20	1,290
Alpha AI, old model	37	.11	730	49	.15	710
Alpha Pony	6	.13	470	6	.13	490
De Laval, old, large	....	....	....	6	.22	500
De Laval, old, small	2	.15	300	32	.21	290
Helice separator	6	.19	1,520	2	.21	1,000
Burmeister & Wain separator	4	.23	450	....	....	....
Radiator	10	.23	....	....	....	....
Extractor	....	....	....	2	.14	400
Hand separator	....	....	....	1	.22	....
Ice method	....	....	....	54	.56	....

The results of the fat determinations in 452 samples of buttermilk from pasteurized and 78 samples from unpasteurized milk or cream are shown in the following statement, together with the losses of fat in the buttermilk from 100 kg. of sweet milk:

Examination of buttermilk in Swedish creameries, 1898.

	Fat content of buttermilk.		Fat in buttermilk from 100 kg. whole milk.	
	Pasteurized.	Not pasteurized.	Pasteurized.	Not pasteurized.
	Per cent.	*Per cent.*	*Kg.*	*Kg.*
Average	0.53	0.51	0.059	0.067
Maximum	1.54	1.52	.26	.22
Minimum	.21	.22	.02	.01
Average for all samples	0.53		0.060	

No unfavorable influence of the pasteurization on the churning was noticeable, the average losses in the buttermilk from 100 parts of whole milk being 0.059 part for pasteurization, against 0.067 part for nonpasteurization. The corresponding figures for 1897 were 0.047 and 0.057, respectively.—F. W. WOLL.

Experiments in butter making, H. H. DEAN (*Ontario Agr. Col. and Expt. Farm Rpt. 1898, pp. 34–40*).—Experiments relating to aeration, pasteurization, ripening of cream, churning, moisture in butter and composite samples for milk testing are reported.

In 17 comparisons of aerated and unaerated milk for butter making, the average scoring was slightly in favor of the butter made from the unaerated milk.

Butter made from pasteurized milk and pasteurized cream was compared with butter made from raw cream in 32 experiments carried on during the summer. There was very little difference in the quality of the butter made in the 3 ways. Pasteurization is considered of considerable value in winter when conditions are less favorable for the production of pure milk.

Butter was made from cream (1) ripened with broad and narrow surfaces exposed to the air, (2) ripened at 60° and 70 to 75° F., (3) stirred frequently while ripening and not stirred, and (4) ripened with 8 to 10 and 16 to 25 per cent starters. In each of the 4 series of experiments, including from 10 to 13 trials, the average results from the 2 methods compared were practically the same.

A comparison was made of churning butter into large lumps before drawing off the buttermilk, and of keeping in granular form until salted. When first made, the lump butter scored slightly higher than granular butter, but after keeping the order was reversed.

Analyses of the butter made in the above experiments are given in a table with notes referring especially to the moisture content. The result of experiments favored the use of ¾ oz. of salt per pound of butter rather than ¼, ½, or 1 oz.

Composite samples of daily milkings for periods of 1, 2, 3, and 4 weeks were tested for 4 months. The samples were preserved with a mixture of potassium bichromate and corrosive sublimate or with Geary tablets, and kept in duplicate in 2 rooms at temperatures of from 60 to 84° and 55 to 70°, respectively. The monthly tests were practically identical with the average of the 4 weekly tests and of the 2 semimonthly tests for the corresponding months. The test of the 3 weeks' sample was also identical with the average of the 3 weekly tests for the same time. The tests were alike for the samples kept at the different temperatures.

Report of Swedish butter exhibitions for the year 1898, N. ENGSTRÖM (*Meddel. K. Landtbr. Styr., 1898, No. 8, pp. 48*).—During 1898, 335 creameries, of which 135 were cooperative, took part in the periodical exhibitions, sending in all 1,303 tubs of butter, an increase of 18 creameries and of 89 tubs over the figures for 1897. The total expense of the exhibitions amounted to nearly $9,000, of which sum the Government contributed $2,680, and the various creameries participating in the exhibitions nearly the whole balance (annual dues per creamery, 50 kroner, or $13.40).

The average water content of the butter exhibited was 13.5 per cent, the range being from 10 to 22.4 per cent. The water content of 83.1 per cent of the butter lay between 12 and 14.9 per cent. Only 14 tubs leaked brine from the time of arrival until judged (a length of time corresponding to that required to bring the butter on the English market); the average leakage was 172 gm., the maximum, 470 gm.

Of the tubs scored 80.6 per cent were made from pasteurized cream and 15.7 per cent from raw cream, while 2.5 per cent was "Radiator" butter; 78.8 per cent of the creameries made pasteurized butter only, against 66.7 per cent in 1897. The creameries also making unpasteurized butter decreased from 16.4 to 9.3 per cent. Pure cultures were used exclusively in 30.8 per cent of the creameries, and at times in 11 per cent; while buttermilk starter was used in 49.5 per cent. Dividing the butter into 3 classes according to its score (perfect 15 points), the following table shows the proportion, in the case of each method of manufacture, which fell in each class:

Relative quality of butter made by different methods of manufacture.

Class.	Score.	Pasteurized.				Not pasteurized.			Radiator butter.
		Pure cultures.	Other starters.	Sweet cream.	Total.	Pure cultures.	Other starters.	Total.	
		Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
1	12 points and over	40.9	47.4	28.6	43.9	7.8	7.1	7.3	15.2
2	10–11.9 points	45.2	43.8	55.1	44.9	47.1	40.9	42.4	72.7
3	9.9 points or lower	13.9	8.8	16.3	11.2	45.1	52.0	50.3	12.1
	Average score (points)	11.27	11.43	11.01	11.34	9.44	9.61	9.57	10.89

All butter exhibited was examined twice during the year for boric acid preservatives, and in no case were such preservatives found.—F. W. WOLL.

Investigations of the formation of molds in storage butter, 1896–1898, R. GRIPENBERG (*Meddel. Mustiala Inst. Forsöksstat. Mejeriafd., Helsingfors, 1899, pp. 51, col. pls. 11*).—The report gives a full account of investigations conducted during 1896-1898 at the dairy division of the Mustiala Institute Experiment Station, for the purpose of studying the causes of moldy butter. The author made a thorough study of the relation of different kinds of parchment paper and butter tubs to mold formation, and through laboratory experiments and storage trials under practical conditions ascertained the factors that would favor the formation of molds in butter, as well as such as would prevent their appearance. The investigations show that earlier views as to the main causes of moldy butter are incorrect. Moldy butter, according to the author, is generally considered to be caused by the use of poor butter tubs, thin parchment paper, prolonged soaking of the tubs in water prior to the packing of the butter, or by leaving the packed and covered tubs standing in the same place for a long time. While it must be admitted that these conditions in a measure favor mold formation in butter, the work done shows conclusively that the appearance of molds is due primarily to infection. In view of the ease with which mold spores are carried about by air currents, and their general distribution, it may be assumed that this infection takes place as frequently in the creamery or dairy itself as later during the storage in butter cellars or storage rooms. Spores of the common mold fungi may also appear on the parchment paper.

It was shown that with a sufficient amount of moisture both the wood and the paper can sustain growths of the molds studied more in detail (principally *Penicillium crustaceum* and *Trichosporium collæ*). Only a very slow growth is made, however, especially when the supply of air is limited, but if this is ample, the temperature higher, and the butter serum penetrates the paper and the wood, the formation of mold will progress very rapidly. Common salt was found to inhibit the growth of molds in proportion to the amount of salt in solution, but even in brine containing 25 per cent of salt colonies of molds were able to grow, although very slowly. Molds were found even when the tubs were cleaned and steamed most carefully and the paper sterilized, showing that spores from the air must have fallen into the tub and adhered to its inner surface or to the paper. If the tubs have become infected with mold spores, mold formation is apparently greatly favored by a careless packing of the butter and by the use of leaky tubs.

The preventive measures against moldy butter which the author recommends are as follows:

(1) Removal of fungi or spores from the tubs by careful scrubbing and rinsing with water containing soda or common salt.

(2) Steaming the tubs 5 or 10 minutes, to kill any remaining organisms.

(3) Soaking the parchment paper in strong brine or steaming it.

(4) Protection of the interior of the tub, as well as the paper and the butter, from spores falling from the air or from the clothes of the butter maker.

(5) The use of as tight and as well-made tubs as possible, and by packing the butter with the greatest care, so that no empty spaces are formed between the butter and the side of the tub.

(6) During the warm season (or even to October 15) the tubs should be lined with heavy parchment paper, preferably Nos. 2, 3, or 4, or else two layers used, e. g. No. 4 on the outside and No. 7 next to the butter.

(7) Rubbing the inside of the tub with salt immediately before the butter is packed. To prevent the introduction of mold spores, the salt is placed in a warm oven for half an hour before being used, and then kept in a covered jar or glass vessel.

(8) Before shipping the packed butter, tubs are kept in as cold and dry place as possible, preferably at a temperature of 4 to 5° C (39 to 41° F).—F. W. WOLL.

Experiments in cheese making, H. H. DEAN (*Ontario Agr. Col. and Expt. Farm Rpt. 1898, pp. 40–64*).—A number of experiments, mainly in continuation of previous work (E. S. R., 10, p. 291), are reported.

Aeration of milk for cheese making (pp. 40, 41).—Thirteen experiments were made during July, September, and October, in each of which cheese was made from aerated and unaerated milk. The average scoring was in favor of the cheese made from the aerated milk. The results, however, are considered unsatisfactory, and the investigation is to be continued during 1899.

Relation of fat in milk to quantity and quality of cheese (pp. 41–52).—The principal results from 27 experiments made in 1898 are summarized in the following table:

Yield and quality of cheese from richer and poorer milk.

Group.	Fat content of milk.		Milk required to make 1 lb. of cheese.	Cheese produced from 1 lb. of fat in milk.	Fat content of whey.	Quality of the cheese.				
	Range.	Average.				Flavor (max. 35).	Closeness (max. 20).	Even color (max. 15).	Texture. (max. 20).	Average total score (max. 90).
	Per ct.	*Per ct.*	*Lbs.*	*Lbs.*	*Per ct*					
1	Below 3	2.92	11.650	2.94	0.133	31.00	16.66	13.66	16.66	77.98
2	3.00 to 3.50	3.14	11.598	2.74	.140	30.23	17.97	14.29	16.85	79.34
3	3.55 to 4.00	3.88	10.209	2.52	.189	30.74	18.16	14.20	17.56	80.66
4	4.05 to 4.50	4.21	9.504	2.49	.213	31.41	18.25	14.56	17.06	81.28
Average		3.57	10.675	2.62	.168					

"It will be noticed in the foregoing table (1) that less milk was required to make a pound of cheese as the percentage of fat increased; (2) that the pounds of cheese per pound of fat in the milk decreased with an increased percentage of fat in the milk; (3) the percentage of fat in the whey increased with an increase of the fat in the milk."

Cheese made from rich milk lost less in weight during one month in the curing room than cheese made from poor milk. In 3 trials the yield of cheese made from a mixture of rich and poor milk was slightly greater than the average yield of cheese made from the 2 milks separately.

Tables give a general summary of 250 experiments along this line made during 5 years. Following are some of the conclusions:

"(1) There is an increased yield of cheese per 1,000 lbs. of milk as the percentage of fat increases An increase of 1 per cent (3.2 to 4.2) in the fat of the milk caused an average increase of nearly 16.5 lbs. of cheese per 1,000 lbs. milk, which at 8 cts. per pound gives an added value of $1.32 per 1,000 lbs. of milk testing 4.2 per cent fat as compared with the value of 1,000 lbs. of 3.2 per cent milk.

"(2) As the percentage of fat in the milk increased there was a gradual decrease in the pounds of cheese made per pound of fat in the milk. Milk testing 3.2 per cent fat produced an average of 2.8 lbs. cheese per pound fat in the milk, while milk testing 1.2 per cent fat yielded an average of 2.5 lbs. cheese per pound of fat in the milk.

"(3) The yield of cheese per pound of fat and casein, the latter estimated by adding 2 to the percentage of fat, ranged from 1.7 to 1.8 lbs. . . . As the yield of cheese is slightly less per pound of fat and casein in the richer milk as compared with the poorer, this system gives a slight advantage to the richer milk when compared with the actual cheese capacity of the two. This is well.

"(4) The experiments prove that not only is the percentage of fat higher in the whey from rich milk, but the total loss of fat per 1,000 lbs. of milk and per 100 lbs. of cured cheese is greater from the rich milk. There was not much difference in the loss of casein in the whey from rich and poor milk.

> "(5) Cheese made from rich milk lost less in curing than did cheese made from poor or medium milk.
>
> "(6) The average of the 5 years' scoring does not show very much difference in the quality of the cheese made from the milk containing the different percentages of fat. In individual cases there was a marked difference in the quality, but when all was averaged this difference largely disappeared. The extreme difference in total points scored in the groups was 2.27 points in favor of the richer milk. The percentage of fat in normal milk is but a small factor in determining the quality of the cheese which is made from it, so long as the fat is about 3.5 per cent."

The application of the results to methods of paying patrons is discussed, the author advocating the method in which the casein is taken account of by adding 2 to the percentage of fat.

> "Our 5 years' experiments prove that this system comes nearest to the actual value of the cheese produced, though it still places a slight premium on the butter fat. It encourages the production of good milk, and at the same time does not discourage the majority of patrons who have average milk, and who are apt to envy those patrons whose cows give a small amount of rich milk and draw a disproportionately large share of the proceeds of cheese sales when the money is divided on the basis of the fat alone."

Effect of setting milk at different temperatures (pp. 52, 53).—In 26 experiments made during September, October, and November, the effect of setting milk at 86° F. was compared with setting at temperatures ranging from 76 to 96°. When set below 80°, the time from setting to dipping and from dipping to salting was increased less than in previous experiments (E. S. R., 9, p. 483). A smaller yield of cheese was obtained from setting at temperatures below 86°. No difference in quality of cheese from setting at different temperatures was shown by the score.

Effect of different quantities of rennet (pp. 55, 56).—Results of experiments in 1898 are given, and conclusions are drawn from 4 years' work:

> "(1) Less than 3 oz. of standard rennet per 1,000 lbs. of milk causes a loss of fat in the whey much greater than is the case by using over 3 oz. of rennet. In the experiments for 1898, where 1 to 2 oz. of rennet was used, the percentage of fat in the whey was 0.45 and 0.30, whereas when a larger quantity was used the fat in the whey was seldom over 0.15 per cent.
>
> "(2) The length of time from setting to dipping and from dipping to salting was much the same whether a large or a small quantity of rennet was used.
>
> "(3) When less than 2 oz. of rennet per 1,000 lbs. of milk was used, the yield of cheese was considerably lessened; but an extra large quantity did not always give an increased yield, though it did in some cases, especially in 1897.
>
> "(4) The highest scoring cheeses were made by using about 3 oz. of standard rennet per 1,000 lbs. of milk.
>
> "(5) The time required for coagulation decreased as the quantity of rennet was increased.
>
> "(6) Cheese having a large quantity of rennet matured more quickly than that made by using a small quantity of rennet in the milk.
>
> "(7) We have endeavored to deduce a law for the effect of rennet on the time required for coagulation, but many difficulties are met, such as the difference in the ripeness of milk, and a difference in the susceptibility of milk for rennet influence. However, roughly speaking, we may say that the average of 4 years' experiments indicate that an increase of from 1 to 2 oz. per 1,000 lbs. of milk decreases the time

for coagulation about 30 minutes; from 2 to 3 oz. the time is decreased 10 minutes; from 3 to 4 oz. the time is decreased 7 minutes; and above 4 oz. the time is decreased an average of about 3 minutes for each increase of 1 oz. of rennet per 1,000 lbs. milk."

Effect of dipping at different stages of acid (pp. 55, 56).—The following conclusions are drawn from experiments made during 4 years:

"(1) Curds dipped with one-eighth to one-quarter of an inch as shown on the hot iron remained less time in the whey than those allowed to develop one-half to one inch of acid, but they took a longer time to mature after dipping before they were ready to salt. The whole length of time from setting to salting was much the same, whether curds were dipped early or late. There is no gain in time by leaving curds in the whey too long.

"(2) There was not a great deal of difference in the yield of cheese from early or late dipping. What difference there was was in favor of early dipping—one-eighth to one-quarter inch acid.

"(3) The loss of fat in the whey first drawn was practically the same in both cases; but the percentage of fat in the whey drippings was, in nearly every case, higher from the curds allowed to develop over one-quarter of an inch of acid in the whey. This explains the harsh nature of acidy cheese. It is, to some extent at least, due to the loss of butter fat from the curds after dipping.

"(4) The quality of the cheese in nearly every case was better from the early dipped curds. Curds allowed to remain in the whey until they show over half an inch of acid are harsh in texture, 'cut' in color, and usually sour to the taste."

Putting curds to press at different temperatures (pp. 56, 57).—Ten experiments were made, in which curd was put to press at temperatures ranging from 60 to 94° F. The highest-scoring cheese was obtained from curd pressed at 82°, and the next highest from curd pressed at 94°. The results of these and previous experiments show that "quite a wide range in temperature may be allowed for putting curds to press, as long as the press room is kept moderately warm to enable the cheese to form a proper rind."

Curing cheese at different temperatures (pp. 57–62).—The effect of temperature in curing cheese was studied in 18 experiments made from June to October, with the following results:

"(1) The cheese lost considerably more during 1 month's curing when kept at a comparatively high temperature. This was true for each month during the experiments and also for the season. The average percentage of shrinkage during the season for 1 month, in cheese weighing about 30 lbs., cured at 60°, was 3.40 per cent; cheese cured at 66° lost 3.85 per cent in weight, and cheese cured at 69° lost 4.31 per cent.

"(2) The quality of the cheese was very much better by curing at 60°. The average score for the season of cheese made in the college dairy was nearly 3 points in favor of cheese cured at 60° as compared with similar cheese cured at 66°, and 5 points higher compared with those cured at 69°. The difference was more marked still in September and October cheese. The flavor was very much better in the cheese cured at 60°, and the texture was a marked improvement. Cheeses cured at a high temperature go off in flavor quickly and have a sandy or mealy texture. Cheese made in October and cured at 60° was pronounced as being worth from 1 to 2 cts. more per pound than similar cheese cured at 70 to 75°. Cheese cured at the lower temperature had very much better keeping quality."

Notes are given on the growth of mold at the different temperatures and on the means employed for preventing it.

Mottled cheese (pp. 62–64).—Starters prepared from mottled cheese, cultures from the bacteriological laboratory originally from the same source, and sour whey were used in 45 experiments made during April, May, August, and September. The conclusions drawn from the results follow:

"(1) Mottled cheese may spread from one day's make to another, but it is most likely to do so from or through the starter.

"(2) The mottles usually appeared in from 2 to 4 weeks after the cheese was made.

"(3) Sometimes a starter produced mottles, and sometimes the same starter did not.

"(4) Pasteurizing the whole milk used in the vat did not prevent mottling.

"(5) In no case did mottles appear in the white cheese made from any of the starters.

"(6) The cultures sent from the bacteriological laboratory did not cause the mottling to any extent. In 1 or 2 cases there was a slight waviness or mottling.

"(7) In some cases the mottles appeared quite strongly and then disappeared after a time. In some cases the mottling appeared in spots through the cheese. A cheese made August 22 was examined on November 29, and the first plug showed no mottles. Out of 5 plugs drawn from different parts of the cheese 2 of them showed mottling.

"(8) Starters made from the whey tank produced mottling of the cheese and a very bad flavor. It is probable that the difficulty is caused in some cases by taking whey home in the milk cans and then sending the milk to the factory in these cans not properly washed and scalded."

Excelsior cheese coating (p. 64).—A test was made of this material, which is claimed to prevent the loss of weight in curing, improve the quality of the cheese, and prevent the growth of mold. It was found to lessen the loss from shrinkage, but did not improve the quality. It is considered doubtful if the results would warrant the expense and trouble in using.

Some investigations in dairy physics, J. B. REYNOLDS (*Ontario Agr. Col. and Expt. Farm Rpt. 1898, pp. 5–7*).—Determinations are given of the rate of expansion of water, skim milk, whole milk, and cream, and of the relative rates of cooling and heating of butter, cream, whole milk, and skim milk, made in an investigation bearing on the theory of separation of cream in deep setting. The methods employed are described and notes given on nonconcordant results relative to the specific heat of milk and cream obtained by different methods. In discussing the rate of expansion of the different substances the author says:

"It is evident that the greater the amount of butter fat or other solids in the milk the more uniform is the expansion. Cream has nearly the same rate of expansion at all temperatures. Pure water increases its rate of expansion quite rapidly with increase of temperature. A second and more important point in the results is in their relation to the separation of cream by the deep setting system. The rate of expansion or of contraction between the limits 68 to 50° F. is, for serum, 0.000175; for cream, 0.000582. The cream, therefore, contracts about 3½ times as fast as the serum within the limits of temperature usual for the deep setting method. Hence, while the serum is always heavier than the cream, the latter very rapidly approaches the specific gravity of the former as they cool. They are therefore becoming more and more nearly equal in weight; so that whatever is the cause of the more rapid separation by the cooling system, it can not be due to an increase in the difference of specific gravity, since the opposite is the case."

Handling dairy cows, G. H. GURLER (*Creamery Jour., 10 (1899), No. 121, pp. 8, 9*).—Brief notes on the care of dairy cows.

Some practical hints on dairying, G. S. THOMPSON (*Jour. Agr. and Ind. South Australia, 3 (1899), No. 4, pp. 354–366*).—Notes are given on the selection of a dairy herd, milk supply, feeding of cows, milk and milking, cream ripening and churning, cheese making, and the symptoms and treatment of a number of diseases of cows.

Dairy stock, H. H. DEAN (*Ontario Agr. Col. and Expt. Farm Rpt. 1898, pp. 66–70*).—A record of the dairy herd showing the yield and cost of milk, butter, and cheese for each cow is given for 3 years.

Some Jersey types, M. B. WOOD (*Dairy Reporter, 3 (1899), No. 32, pp. 502, 503, figs. 15*).—Brief historical notes on a number of individuals.

Oats and peas and oats and tares as soiling crops for milch cows, G. E. DAY (*Ontario Agr. Col. and Expt. Farm Rpt. 1898, pp. 78–80*).—Two cows were fed oats and peas for 11 days and 2 were fed oats and tares for the same time. The rations were then reversed and the feeding was continued for 11 days. The yields of milk during the last 6 days of each period are summarized. The results are considered as showing that there is very little difference if any between oats and peas and oats and tares for milk production.

Sugar beets vs. mangels for milch cows, G. E. DAY (*Ontario Agr. Col. and Expt. Farm Rpt. 1898, p. 80*).—Two cows were fed sugar beets and 2 were fed mangels for 2 weeks. The rations were then changed and fed for 2 weeks longer The yields of milk are given. The results are slightly in favor of mangels, but are not considered conclusive.

Influence of feed on quantity and quality of milk, F. C. CURTISS (*Ontario Agr. and Expt. Union Rpt. 1898, pp. 50–56*).—A brief discussion of the subject with the following conclusion: "Feed is in various ways an extremely important factor that must be reckoned with in its effect on both the quantity and quality of dairy products, though the immediate modification in quality that may be attributed to feed is comparatively slight."

The acid test for milk, W. J. SPILLMAN (*Dairy and Creamery, 1 (1899), No. 21, p. 6; Amer. Cheesemaker, 14 (1899), No. 165, p. 4*).—A brief popular discussion on the practical value of determining the acidity or milk and cream.

Bacteriology and the dairy industry, D. ROBB (*Dairy, 11 (1899), Nos. 130, pp. 299–301; 131, pp. 358–360*).—This treats popularly of the discovery and morphology of bacteria, their origin and action in milk, and their use in butter and cheese making.

Bacteria in butter and in other dairy products, WEISSENFELD (*Berlin. Klin. Wchnschr., 36 (1899), No. 18, pp. 1053–1055*).—Tests were made with 32 samples of butter, in which the tubercle bacillus was found in 10 cases. Nutrose, eucasin, calcium phosphate-casein, and plasmon were also investigated, and found to contain quantities of cocci and diplococci.

New bacilli causing butyric fermentation in market milk, A. SCHATTENFROH and R. GRASSBERGER (*Centbl. Bakt. u. Par., 2. Abt., 5 (1899), No. 7, pp. 209–211*).—The physiological-chemical behavior of three forms is described, which were found in market milk. They cause a vigorous fermentation in sterilized milk, with the production of butyric acid, but not butyric alcohol. The casein is precipitated but not peptonized.

The milk of the dairies of Genoa in relation to tuberculosis, A. MASSONE (*Riv. Ig. e San. Pubb., Roma, 9 (1898), No. 7, pp. 250–252*).—The milk from the city cows was found less infected with tuberculosis than that from the surrounding countries.

Part played by moisture in the curing room, S. J. TAYLOR (*Amer. Cheesemaker, 14 (1899), No. 166, p. 6*).—A popular discussion on the construction of curing rooms with reference to the control of temperature and moisture.

Cheddar cheese, F. J. LLOYD (*Amer. Cheesemaker, 14 (1899), No. 165, pp. 1, 2*).—A discussion of conditions essential to its manufacture in England.

Cooperative experiments in curing cheese, H. H. DEAN (*Ontario Agr. and Expt. Union Rpt. 1898, pp. 45–48*).—The results of a number of experiments relating to the effects of temperature in curing cheese are summarized in tabular form and directions are given for the determination of moisture in cheese curing rooms. It was found that cheese cured at 60 to 65° F. lost about 1 per cent less by shrinking and was of superior quality as compared with similar cheese cured at 70 to 80°.

Miscellaneous dairy notes, H. H. DEAN (*Ontario Agr. Col. and Expt. Farm Rpt. 1898, pp. 70–74*).—Notes are given on milk tests at fairs and farms, thermometers and hygrometers for the dairy and curing room, testing new churns, construction of the curing room, dairy exhibit at the industrial fair at Toronto, and fly mixtures for cows.

VETERINARY SCIENCE AND PRACTICE.

Contribution to the study of the origin of antityphic substances, L. DEUTSCH (*Ann. Inst. Pasteur, 13 (1899), No. 9, pp. 689–727*).—In this article the author reports the results of studies undertaken to demonstrate the method and place of formation of substances which are antagonistic to the development of typhus, and the results of his study of the formation of agglutinating substances under similar circumstances. The results of the author's work may be briefly summarized as follows: A single intraperitoneal injection of the typhus culture induced the formation of the antagonistic substances in guinea pigs. Antityphic properties appeared in the serum about the fourth or fifth day, increased so that the maximum was reached about the eleventh or twelfth day, and then gradually diminished, but could, however, be demonstrated as present for fully a month after the injection. The antityphic property is rather considerable in the liver, kidneys, and suprarenal capsules. In from one fourth to one-fifth of the cases the bone marrow was more active than the serum, and this was true of the spleen in one-half of the cases. The lymphoid organs are in some manner connected with the formation of the antagonizing substances, this connection being demonstrated by a large number of experimental facts.

With regard to the formation of agglutinating substances, the following were the main results obtained: An intraperitoneal injection of a heated typhus culture induced the appearance of an agglutinating power in the serum of the guinea pig. The appearance and development of this power is subject to the same laws as the development of the antagonizing substances. The liver, kidneys, and suprarenal capsules of immunized animals contain only traces of agglutinins. The lungs may be considered as the only organ of the guinea pig which usually possesses a greater agglutinating power than the serum.

The relative virulence for the domestic animals of human and bovine tubercle, R. R. DINWIDDIE (*Arkansas Sta. Bul. 57, pp. 21–95*).—The purpose of the experiments which are recorded in this bulletin was to determine certain factors in the question of the transmission of tuberculosis from man to animals and from animals to man. The first part of the bulletin consists of a review of some of the literature on the subject of tuberculosis with a brief bibliography.

Experiments were made upon 20 calves, 16 pigs, 2 sheep, 16 chickens, and several guinea pigs and rabbits. Experiments were conducted in 2 ways, by feeding the tubercle material and by intraperitoneal inoculations. The majority of the experiments were comparative in that a part of the experiment animals were fed or inoculated with tuberculous human sputum and another part were fed or inoculated with tuberculous material of bovine origin.

In the feeding experiments the author made use of 4 cattle, 6 pigs, and 6 chickens. The tuberculous material was fed in small, frequently repeated doses, either mixed with milk or dry with bran. The 4 cattle consisted of 2 calves and 2 two year olds. The minimum dose of human tuberculous sputum was 10 cc. and the maximum 60 cc. The feeding period extended from August to October, 1896. On December 29 all 4 failed to respond to the tuberculin test. On March 8, 1897, all 4 animals were killed and proved to be entirely free from tuberculosis. Six pigs received 20 doses of sputum, and when killed, 10 months after the beginning of the experiment, 2 of them exhibited slight tubercular lesions. No tubercular infection was produced in chickens by the feeding experiments.

In the inoculation experiments, 8 calves and 4 pigs received intraperitoneal inoculations of either human or bovine tubercle materials. The human tubercle material was from pulmonary tuberculosis. The bovine material came from caseous, degenerated lungs or thoracic lymph glands. Besides the inoculation experiments with tuberculous material, such as has been described, other intraperitoneal inoculations were made with artificial cultures of tubercle bacilli, these experiments being conducted upon calves, chickens, pigs, and sheep. Artificial cultures were also fed to calves and pigs for experimental purposes.

The results of the experiments may be brought together in the following statements: Feeding the tuberculous sputum of man to calves gave negative results. Intratracheal inoculations of sputum and bovine tubercle material as well as the intraperitoneal inoculations of the same two sorts of material gave results which indicate that the tuberculous material of bovine origin acts more virulently upon cattle than the tuberculous sputum of man. The feeding of tuberculous sputum to 6 pigs resulted in a slight infection of 2 of them. The intraperitoneal inoculation of sputum and bovine tubercle in 4 pigs resulted in tuberculous infection of both pigs which were inoculated with the bovine material and of 1 which was inoculated with the human material. An intraperitoneal inoculation of pure cultures of human origin in the pig produced no lesions. Similar inoculation of bovine origin in 2 pigs gave in one a generalized and in the other a localized tubercular infection.

In the sheep intraabdominal inoculations of pure cultures of bovine origin gave a more virulent form of the disease than the inoculation of pure cultures of human origin. Intraabdominal inoculations of sputum and of bovine tubercle material gave negative results in chickens.

With regard to the relative susceptibility of different animals the results obtained may be summarized as follows: Bovine tubercle is more virulent than human tubercle for cattle, sheep, goats, and rabbits; while horses, pigs, cats, and dogs seem to be equally susceptible to both varieties. The author believes that the former result can not be interpreted as lending weight to the theory that human and bovine tubercle are 2 distinct varieties. The fact that the disease develops differently in cattle and in man is interpreted by the author as meaning that the 2 organisms react differently to the same pathogenic agent. The author's experiments lend weight to the theory that human tuberculosis is not a serious source of danger in the infection of cattle, and that the majority of cases of infection in cattle come of bovine origin. The experiments recorded in this bulletin are not intended to throw any light upon the question of the danger of the infection of human beings by the use of tuberculous meat and milk.

Bovine tuberculosis, C. E. THORNE (*Ohio Sta. Bul. 108, pp. 287–372, figs. 9*).—This bulletin contains a general account of the nature of tuberculosis, of the properties of the tuberculin test, and of the method for applying this test. Tuberculosis having broken out in the station herd, the animals were all tested with tuberculin furnished by the Bureau of Animal Industry of this Department. Details are given of the temperature records during the tuberculin tests and of the *post-mortem* examinations in those cases which were slaughtered. In discussing the effects of the tuberculin test upon the animals, the author concludes that the tests conducted at the station "can not be interpreted as supporting the theory that the tuberculin test will arouse dormant cases of tuberculosis and start the disease into a more active form."

The author discusses the problem of the disposal of the meat and other products of tuberculous animals, and believes that the experiments conducted at the station indicate that cattle may be useful for several years after infection with tuberculosis. The tuberculin test may be repeated as often as once a month without harm to the animal and even in some cases with an apparent curative effect. In herds which are not suspected of being tuberculous the test need not be repeated oftener than once in 6 months.

Regarding the prevalence of the disease in swine, 7 Berkshire pigs from a sow which was believed to be free from tuberculosis were chosen for experiment. A portion of them were fed with pasteurized milk and another portion with unpasteurized milk. At the end of the experiment, however, it was found that all the pigs were thoroughly infected with tuberculosis. Later it was discovered that the sow was also suffering from the disease, and that there was a large tubercular mass in the udder. It would appear that all the pigs had been infected from that source.

After a review of the literature which bears upon the prevalence of tuberculosis in different countries, and in the States of this country, the author states his belief that it will be possible to eradicate the disease completely from any herd, or even from the whole State.

A large portion of the bulletin is occupied with a discussion of the answers to lists of questions which were distributed among the health officers and veterinarians of the State. These questions had regard to the prevalence of tuberculosis in dairy cattle, the extent of the application of the tuberculin test and of meat and milk inspection. The answers indicate that there have been discovered numerous cases of tuberculosis in cattle furnishing milk to cities, and that the tuberculin test is not applied as extensively in the State as it should be. The author discusses in some detail the relationship of bovine tuberculosis to the public health, and the question of the identity of the bacillus in the human and bovine form of the disease. In this discussion statistics from census reports and the scientific literature on the subject are drawn upon freely. In regard to the question of the possible hereditary origin of tuberculosis, the author believes that nearly all, if not quite all, cases of tuberculosis, arise after birth from external infection, or are at least congenital in contradistinction to hereditary. Tuberculosis has been experimentally produced in calves at the Ohio Station by feeding the milk from tuberculous cows.

The author considers the question as to whether it is safer to use the milk of one cow or mixed milk for infants. His opinions are based upon the testimony of numerous physicians of the State, 339 reports having been made in reply to a series of questions from the station. A majority of the physicians with country practice were of the opinion that the milk from one cow is better than mixed milk, whereas the opposite opinion was held by a majority of physicians with city practice. This difference of opinion, the author believes, is due entirely to the difference of environment, it being practically impossible for any except wealthy persons to keep a cow in a city under normal conditions. From the replies of the physicians of the State, as well as from other statistics compiled by the author, it is stated that probably a large proportion of cases of death from intestinal trouble of infants is directly attributable to the use of tuberculous milk. The physicians consulted agreed that cow's milk is safer than mother's milk if the mother is tuberculous.

The author has compiled statistics which would indicate that in Ohio the number of deaths from tuberculosis is not decreasing. It has been shown by statistical methods in many countries that bovine tuberculosis is increasing at the same time that human tuberculosis is decreasing, and it has been assumed from this inverse proportion that perhaps bovine and human tuberculosis are not identical diseases. The author believes the balance of evidence is in favor of the belief that the bovine and human forms of tuberculosis are not distinct diseases, but that there is sufficient evidence for us to believe that tuberculosis is produced in the lower animals by inoculation with material from human subjects, and that man has frequently contracted the disease from tuberculosis material of bovine origin.

Investigations on the nature and etiology of milk fever, H. Van de Velde (*Monatsh. Prakt. Thierh., 11 (1899), No. 3, pp. 97–113, fig. 1*).—In studying this disease the author made a careful record of the clinical symptoms and peculiarities of different cases, and examined microscopically and by means of cultures, the various micro-organisms which he found in connection with each case. In all cases where the disease resulted in death, a thorough *post-mortem* was made. Experimental inoculations were made upon other animals and antistreptococcic sera were employed for the purpose of determining their effect in checking the activity of the pathogenic organism.

The results of the author's investigations may be summarized as follows: Of the 14 cases of milk fever which were observed, the majority were of the paralytic form, and 7 of these cases were fatal. The organisms which were most frequently found were streptococci, staphylococci, and coli bacilli. Milk fever may be caused by simple infection, by one organism, or by mixed infection by several organisms. In simple infections, streptococcus was more frequently the cause of the disease, and the same organism seemed to be the most important one in cases of mixed infection. The streptococci, which were determined as the cause of milk fever, were not to be distinguished in any way from those which were found in cases of puerperal septicæmia of man.

Report of the professor of veterinary science, J. H. Reed (*Ontario Agr. Col. and Expt. Farm Rpt. 1898, pp. 31, 32*).—A brief report of the diseases treated during the year.

Report of the verterinary division of the ministry of internal affairs for 1896 (*Otchet Veterinarnago Otdyeleniya Ministerstva Vnutrennikh dyel. St. Petersburg, 1899, pp. 544*).—A statistical record of the various diseases of domesticated animals in Russia.

Report on the veterinary service and meat inspection in Norway for 1897 (*Beretning om Veterinärväsenet og Kjödkontrollen i Norge. Christiania: Director Civil Veterinary Service, 1899, pp. 241*).—A report, with extensive statistical tables, on anthrax, blackleg, hog cholera, swine plague, tuberculosis, and other diseases of domesticated animals in Norway.

Twenty-fifth annual report of the Royal Institution for the Cultivation of Cow-pox Virus at the Royal Veterinary School of Utrecht, with an appendix of the results obtained in the vaccination of animals, on the origin of the Royal Cow-pox Institution, and its activity during the first twenty-five years (1873 to 1897), A. W. H. Wirtz (*Utrecht, 1899, pp. XX + 92*).—This report contains a historical account of the institution and a detailed description of the method of cultivating cow-pox virus, including a discussion of the effects upon the calves which were used for this purpose.

The rôle of insects in spreading infectious diseases of man and animals, R. Abel (*Hyg. Rundschau, 9 (1899), No. 21, pp. 1065–1070*).—This paper contains a number of observations on insects as carriers of disease and is supplementary to Nuttall's work on this same subject.

On the etiology of tetanus, R. MORSELLI (*Gior. R. Soc. Accad. Vet. Ital., 48 (1899), No. 40, pp. 946–948*).—Observations on cases of traumatic and other forms of tetanus.

Tetanolysin, T. MADSEN (*Ztschr. Hyg. u. Infectionskrank., 32 (1899), No. 2, pp. 214–238, figs. 4*).—In cultures of the tetanus bacillus tetanolysin is formed, for which there is a specific antitoxin, known as antilysin. The effects of the lysin and its antipathetic substance can be readily determined by staining methods. Tetanolysin combines with the red blood corpuscles.

Heredity, disposition, and immunity in connection with tuberculosis, F. LÖFFLER (*Arch. Wiss. u. Prakt. Thierh., 25 (1899), No. 6, pp. 427–442*).—An account of the diseases which predispose to tuberculosis, and a study of the hereditary factor.

The methods of transmission of tuberculosis, C. FRÄNKEL (*Arch. Wiss. u. Prakt. Thierh., 25 (1899), No. 6, pp. 396–417*).—A thorough study of the various ways by which the disease is communicated from animal to animal or from man to man.

The tubercle bacillus and its relationship to tuberculosis, FLÜGGE (*Arch. Wiss. u. Prakt. Thierh., 25 (1899), No. 6, pp. 385–395*).—The tubercle bacillus is an obligate parasite and is found in the outer world only in consequence of its escape from the tubercular material of animals and man.

The localization of the tubercle bacillus after direct inoculation into the left ventricle, P. L. FRIEDRICH and H. NÖSSKE (*Beitr. Path. Anat. u. Allg. Path., 26 (1899), No. 3, pp. 470–510, pl. 1*).—The course of the disease under these circumstances was shown to vary exceedingly in different cases and to be influenced largely by the presence of other organisms mixed with the tubercle bacillus.

The growth of tubercle bacilli upon culture media containing potato, E. TOMASCZEVSKI (*Ztschr. Hyg. u. Infectionskrank., 32 (1899), No. 2, pp. 246–267.*—The results published by Lubinski and Sander are not supported by the author's observations. Occasionally a luxuriant growth of tubercle bacilli took place upon potato cultures, but this was the exception. No decided change was noticed even after three or four generations of such cultures. On the contrary, an unfavorable influence was manifested.

On the acid-proof bacteria of the tubercle-bacillus group, G. MAYER (*Centbl. Bakt. u. Par., 1. Abt., 26 (1899), No. 11–12, pp. 321–336, figs. 5*).—A study of several of these bacteria with special regard to the differences shown in their growth and in their pathogenic reaction.

Mixed infection in tuberculosis, R. PFEIFFER (*Arch. Wiss. u. Prakt. Thierh., 25 (1899), No. 6, pp. 418–426*).—An account of the other pathogenic organisms which are found in connection with tubercular infection.

Experiments on the danger from meat of tuberculous animals, D. VAN DER SLUYS (*Ztschr. Fleisch u. Milchhyg., 10 (1899), No. 1, pp. 8–12*).—Out of 10 young pigs fed with tuberculous meat, 3 became infected with tuberculosis.

The administrative control of tuberculosis, R. T. THORNE (*London: Baillière, Tindall & Cox, 1899, pp. 73, figs. 2*).—In this book a series of lectures by the author is brought together which deal with the methods for regulating and controlling the spread of human and bovine tuberculosis.

Tuberculosis in cattle, D. MCEACHRON (*Queensland Agr. Jour., 5 (1899), No. 3, pp. 305–310*).—A brief general discussion of problems connected with the reduction of this disease.

Bovine tuberculosis in Argentine Republic, SIVORI (*Rec. Med. Vet., Paris, 8. ser., 6 (1899), No. 19, pp. 603–607*).—A discussion of the prevalence of tuberculosis as found in milch cows and in beef animals.

Bovine tuberculosis (*La tuberculosis en el ganada bovino. Argentine Republic, Dept. Agr., 1899, pp. 15*).—A discussion of means of contagion and diagnosis of tuberculosis and a report of results obtained by the application of the tuberculin test.

Report of an inquiry into the prevalence of tuberculosis in dairy cows as revealed by the tuberculin test, W. AXE (*Jour. British Dairy Farmers' Assoc., 14*

(1899), No. 3, pp. 245–259).—Gives the proportion of reacting animals of different breeds. Special attention was given in these experiments to an examination of the udders.

Tuberculosis in cattle, S. S. Cameron (*Queensland Agr. Jour., 5 (1899), No. 1, pp. 71–81*).—This paper is a report of tuberculin tests made in Victoria. Two hundred and seventy-six cattle were tested and 9 per cent reacted. All the animals which reacted were shown by *post-mortem* examinations to be tuberculous.

Tuberculosis in cattle and its control, O. E. Stenström (*Milch Ztg., 28 (1899), Nos. 29, pp. 449, 450; 31, pp. 483, 484; 32, pp. 499–501*).—A study of the relative susceptibility of different ages, sex, and races of cattle to tuberculosis.

The measures to be taken against tuberculosis of the domesticated animals, B. Bang (*Jour. Comp. Path. and Ther., 12 (1899), No. 3, pp. 189–205*).—Reports extensive tuberculin tests which indicate that tuberculosis is not usually a congenital disease. For control of tuberculosis, it is necessary to prevent the infection of calves to kill badly diseased animals, to give special attention to tuberculosis of the udder, and to heat the milk which is returned from public creameries after separation.

Inoculation as a preventive of tick fever, F. Gostling (*Queensland Agr. Jour., 5 (1899), No. 1, pp. 86–89*).—Inoculation furnishes effective prophylaxis. In cattle 2 years of age the loss from inoculation amounts to 1 per cent, while in older cattle it may reach 5 per cent. The inoculation of pregnant animals did not produce a greater mortality than was shown in other cattle.

Observations on ticks and tick fever at the Indooroopilly Experiment· Station and at St. Helena, C. J. Pound (*Queensland Agr. Jour., 5 (1899), No. 1, pp. 81–86, pls. 2*).—Experiments conducted upon inoculated and uninoculated cattle showed that the ticks are not destroyed and the spread of the fever is not checked during the winter months. Experiments demonstrated that inoculation when properly performed is not attended with serious loss and is an effective method of securing immunity to the fever.

Anthrax in West Gothland, A. G. Florén (*Svensk Vet. Tidskr., 4 (1899), No. 7, pp. 308–311*).—This is a report on the study of the origin of the infection which caused a considerable loss.

Effect of injection of bile from animals which died of anthrax, B. Morpurgo (*Riv. Ig. e San. Pubb., Roma, 9 (1898), No. 1, pp. 9–14*).—The injection of bile did not cause infection nor did it produce immunity.

Memorandum upon protective inoculation against anthrax, F. Tidswell (*Agr. Gaz. New South Wales, 10 (1899), No. 9, pp. 883–891*).—Inoculation of sheep against anthrax in New South Wales caused a considerable number of deaths, but was generally successful.

The danger from anthrax in working with animal hair and the preventive measures to be adopted, Kübler (*Arb. K. Gesundheitsamte, 15 (1899), No. 3, pp. 456–475*).—Treatment of the hair with boiling water or steam gave good results. Potassium permanganate in a 2 per cent solution is effective in destroying the anthrax bacillus if the treatment is continued for one-half hour. Live steam proved to be the most reliable disinfectant.

Cattle plague in South Africa, P. M. Edgar (*Veterinarian, 72 (1899), No. 862, pp. 707–718*).—An etiological and pathological study of the disease.

Vaccination against blackleg, S. Arloing (*Jour. Med. Vet. et Zootech, 5. ser., 3 (1899), pp. 573–586*).—A discussion of the precautions to be observed in order to prevent accidents and secure effective protection against the disease.

Observations on contagious foot-and-mouth disease and its control, A. G Florén (*Svensk Vet. Tidskr., 4 (1899), No. 6, pp. 231–242; 7, pp. 269–299*).—This article contains a description of the course of the disease in sheep, goats, cattle, hogs, and man. Experiments were conducted in making lymph inoculations for producing immunity.

Inoculations with Seraphthin, H. REICHENBACH (*Schweiz. Arch. Thierh., 41 (1899), No. 5, pp. 213–216*).—From experiments on 50 cattle this substance was found to be worthless as a preventive of foot-and-mouth disease.

A report on the disease affecting cattle in the Moruya district, J. D. STEWART (*Agr. Gaz. New South Wales, 10 (1899), No. 11, pp. 1205–1209, pl. 1*).—Upon investigation of this disease, it was found that the cattle had been poisoned by eating *Macrozamia spiralis.*

The dying of young calves, H. M. SCHMIDT (*Landw. Wchnbl. Schleswig-Holstein, 49 (1899), No. 41, pp. 749–753*).—Recommends the thorough disinfection of the cows with a solution of corrosive sublimate.

Milk fever and the new treatment, L. PEARSON (*Hoard's Dairyman, 30 (1899), No. 37, pp. 738, 739*).—Experiments with the iodid of potash method.

Carbolic acid and glycerin in the treatment of milk fever, C. FABBRETTI (*Gior. R. Soc. Accad. Vet. Ital., 48 (1899), No. 42, pp. 985–989*).

Veterinary notes, R. G. SAUNDERS (*Colonial Col. Mag., 5 (1899), No. 5, pp. 301–306*).—An account of the treatment of milk fever by iodid of potash and of the effect of spaying on the milk production of cows.

Abortion of cattle (*Vet. Jour., 49 (1899), No. 292, pp. 231–236*).—A general account of the different forms of this disease.

The value of separation and disinfection in combating abortion, J. SPEIR (*Jour. British Dairy Farmers' Assoc., 14 (1899), No. 3, pp. 228–230*).—The incubation period for this affection was found to be not less than from 40 to 42 days.

Protective inoculation against pleuro-pneumonia in Magdeburg, LEISTIKOW (*Arch. Wiss. u. Prakt. Thierh., 25 (1899) No. 6, pp. 443–450*).—Recommends the killing or protective inoculation of all cattle of infested herds.

A study of Bilharzia crassa in Sicily, P. BARBAGALLO (*Gior. R. Soc. Accad. Vet. Ital., 48 (1899), No. 37, pp. 865–873*).—A study of the parasitic life of this worm in cattle and sheep.

Caseous broncho pneumonia of sheep caused by the bacillus of Nocard-Preisz, F. SIVORI (*Rec. Med. Vet., Paris, 8. ser., 6 (1899), No. 20, pp. 657–671*).—In this paper the author makes a report on a disease among sheep in the Argentine Republic. The disease has been mistaken for tuberculosis and has also been called pseudotuberculosis. A large number of autopsies were made, on which the description of the pathological anatomy of the disease is based. The pathogenic organism was cultivated on several nutrient media, and experimental inoculations were performed on guinea pigs, rabbits, pigeons, white mice, goats, dogs, and sheep. When the culture is not especially virulent, the subcutaneous inoculation of the organism in sheep produces a large abcess. Intraperitoneal inoculation in the sheep causes death within a short time.

Epilepsy and Eclampsia, A. TAPKEN (*Deut. Tierärztl. Wchnschr., 7 (1899), No. 40, pp. 353–356*).—A study of this disease in horses, cattle, and hogs.

Observations on hog cholera and swine plague, G. GEROSA and G. BILLITZ (*Milch Ztg., 28 (1899), No. 30, pp. 465–468*).—Blood serum of experimental animals had neither preventive nor curative action.

Protective inoculations against hog cholera according to Lorenz and with Susserin, H. JOST (*Berlin. Tierärtztl. Wchnschr., 1899, No. 41, pp. 493–495*).—In a considerable number of experiments Susserin proved a valuable curative reagent for hog cholera.

The cure of hog cholera with intravenous injections of corrosive sublimate V. COLUCCI (*Gior. R. Soc. Acad. Vet. Ital., 48 (1899), No. 42, pp. 889, 890*).

Comparative investigation of the bacteria of hog cholera and swine plague, BÖDER (*Arb. K. Gesundheitsamte, 15 (1899), No. 3, pp. 373–386*).—The author claims that the organism of these two diseases can be distinguished by their unequal power of motion, the formation of cilia, their growth on agar and bouillon media, the formation of indol, and their zymogenic power. It is not thought probable that there are four related hog diseases, as some authors have maintained, but the two mentioned above are said to be easily differentiated.

Measures to be taken against the epizootic diseases of the pig, E. LECLAINCHE (*Jour. Comp. Path. and Ther., 12 (1899), No. 3, pp. 206-216*).—From a study of the great epizootics of swine fever it is concluded that not one arose by an extension of an old center of infection, but that all came by importation of fresh infection. The prevention of the disease lies, therefore, in the author's opinion, within the powers of the sanitary police officers.

Parasites in the stomach of the hog, S. VON RATZ (*Ztschr. Tiermed., 3 (1899), No. 4-5, pp. 322-329*).—Discusses *Simondsia paradoxa*, *Spiroptera strongylina*, and *Gnathostoma hispidum*.

Cerebro-spinal meningitis of the horse, CADÉAC (*Jour. Med. Vet. et Zootech., 5. ser., 3 (1899), pp. 523-526*).—A study of the symptoms of this disease.

Absorption of virus by the conjunctiva, V. GALTIER (*Jour. Med. Vet. et Zootech., 5. ser., 3 (1899), pp. 513-519*).—A report on a series of experiments in which it was shown that glanders could be transmitted by contact of the virulent matter with the conjunctiva without any pathological conditions arising in the conjunctiva.

The diseases of poultry, D. E. SALMON (*Washington, D. C.: G. E. Howard, 1899, pp. 248, figs. 71*) —A general treatise on the subject, arranged under the following chapters: Introduction; diseases of the organs of respiration; diseases of the organs of digestion; diseases of the peritoneum, liver, and spleen; diseases of the organs of urination and reproduction; diseases of the brain; diseases of the heart and blood vessels; parasites and diseases of the skin; diseases of the feet and legs; infectious diseases having a tendency to affect more than one set of organs; and injurious habits and vices.

Diseases of poultry, A. T. PETERS (*Nebraska State Bd. Agr. Rpt. 1898, pp. 233-237*).—A report of experiments in the destruction of fleas on poultry, in the use of the antitoxin treatment for roup, and in vaccination against fowl cholera.

Serum inoculation against fowl cholera, H. PRASSE (*Berlin. Tierärztl. Wchnschr., 1899, No. 45, pp. 542, 543*).—Experiments conducted upon 3 geese, 40 ducks, and 39 chickens showed that perfect immunity could be obtained by the use of serum.

Diphtheria of fowls, A. KLAVIKTER (*Schleswig-Holstein. Bl. Geflügelzucht, 21 (1899), No. 10, pp. 100-103*).—A study of the methods of infection and of means for preventing this disease.

Intracerebral inoculation of rabies virus, E. LECLAINCHE and C. MOREL (*Rev. Vet. Toulouse, 24 (1899), No. 10, pp. 593-598*).—By performing this operation in series, the virulence of the virus was increased, the incubation period being reduced from 16 to 9 days.

The germicide power and poisonousness of the three isomeric cresols and phenol, H. HAMMERL (*Hyg. Rundschau, 9 (1899), No. 20, pp. 1017-1028*).—Paracresol is shown to be equally as good as orthocresol for disinfecting, but more poisonous. Phenol is less poisonous than either, but is also less powerful as a disinfectant.

STATISTICS—MISCELLANEOUS.

Eleventh Annual Report of Alabama Station, 1898 (*Alabama Sta. Rpt. 1898, pp. 38*).—This includes the organization list of the station; financial statement for the fiscal year ended June 30, 1898; summary of the bulletins issued during the year; list of the subjects treated in the 100 bulletins issued since the organization of the station in 1888; list of exchanges; and departmental reports reviewing the work of the station along the different lines. The report of the associate chemist contains notes on methods employed at the station in investigations to determine the available plant food in soils, water requirements of the cotton plant, sources of nitrogen in leguminous plants, and the available phosphoric acid in phosphate.

Eleventh Annual Report of West Virginia Station, 1898 (*West Virginia Sta. Rpt. 1898, pp. 48, pl. 1*).—In addition to the organization list of the station and a financial statement for the fiscal year ended June 30, 1898, this contains a general review of the work of the station by the director, and more detailed reports by the chemist, entomologist, and horticulturist, enumerating the different lines of work and giving notes on the progress made during the year.

Crop circular for October, 1899, J. HYDE (*U. S. Dept. Agr., Division of Statistics Crop Circ., Oct., pp. 4*).—This contains notes on the condition of the principal crops in the United States and foreign countries, estimates of the world's wheat crop of 1899, and a table giving the average yield per acre, average quality, and average condition of crops by States and Territories, October 1, 1899.

Bulletin on the state of the crops in the Province of Quebec in July, 1899 (*Prov. Quebec, Dept. Agr., 1899, pp. 13*).—Summarized statistical data, showing the condition of the more usual farm crops with comments, and notes from correspondents.

Crops and live stock in Ontario (*Ontario Bureau Ind. Bul. 64, pp. 12*).—This bulletin gives the precipitation and temperature from November, 1898, to April, 1899, and a summary of reports on the condition of crops and live stock in the Province on May 1, 1899, with statistics on the agricultural products of Manitoba for 1897 and 1898.

The world's grain crops in 1899, J. HYDE (*U. S. Dept. Agr., Division of Statistics Circ. 11, pp. 8*).—English, French, and Hungarian estimates of the world's wheat crop of 1899 are given and discussed in connection with estimates of the Department. The estimates of the Hungarian ministry of agriculture of the total production of rye, barley, oats, and corn are also given.

The Brazos River (Texas) flood of June-July, 1899, and its effects upon the agriculture of the submerged region, E. S. HOLMES, Jr. (*U. S. Dept. Agr., Division of Statistics Circ. 10, pp. 8*).—In connection with a general account of the flood and of the agriculture of the flooded district estimates are given of the damage to property. The area covered by the flood contained a population of about 100,000. The region included 8,100 farms with an area of 1,383,350 acres and a total valuation, including farm implements, live stock, etc., of $23,445,555. The estimated total loss to farm property and crops amounted to $7,412,583.

Suggestions on farm accounts, C. D. SMITH (*Michigan Sta. Spec. Bul. 9, pp. 12*).—Practical method of keeping farm accounts are described and illustrative examples given.

Eighteenth Congress of German Wine Growers at Würzburg, September 16-20, 1899 (*Chem. Ztg., 23 (1899), No. 78, pp. 818-820*).—The papers dealt largely with methods of combating insects and fungus diseases.

NOTES.

Kansas Station.—At a recent meeting of the board of regents the management of the station was placed in the hands of a station council, composed of the president of the college, as chairman, and the heads of the various departments in the station. J. T. Willard was elected director, the office being charged with the executive duties, but not with the planning or supervision of work. The council is to hold regular monthly meetings. It was decided to lease suitable land for continuing experiments with the sand plum with a view to its improvement. A. T. Kinsley, B. S., has been appointed assistant in the veterinary department.

Oklahoma College and Station.—J. G. Kerr, B. S., a graduate of the Texas Agricultural College, has been appointed assistant in agriculture in the college and station.

Rhode Island Station.—George M. Tucker, formerly a regular assistant in agriculture and since his return from study in Europe a volunteer assistant at the station, has become general manager of a coffee and rubber plantation in the state of Oajaca, in Mexico, some 200 miles from Vera Cruz. The plantation is operated by Rhode Island capitalists.

Virginia College and Station.—The administration building was burned February 1. The building contained many valuable college and station records, and the station library and files of publications, all of which were lost. W. B. Alwood has been given a year's leave of absence for European travel and study. He plans to visit many of the agricultural institutions of England, France, and Germany, and will pay especial attention to recent progress in fermentation as applied to the manufacture of vinegar and other fermented products from cider. John F. Ryan, of Arcola; B. B. Brockenbrough, of Tappahannock; W. Wyndham Robertson, of Saltville, and J. S. Musgrave, of Pinopolis, have been appointed members of the board of visitors, to serve for four years, in place of W. B. Price, S. H. Graves, J. M. Barton, and H. L. Maynard, whose terms expired December 31, 1899.

West Virginia Station.—T. F. Watson, assistant chemist, died January 14, after a severe illness with typhoid fever and pneumonia.

Post-Graduate Study at Washington.—The committee of the Association of American Agricultural Colleges and Experiment Stations on post-graduate study at Washington has brought the matter definitely before the regents of the Smithsonian Institution and proposed a tentative plan for an office of post-graduate study in the Smithsonian Institution. The matter has been considered by a special committee of the board of regents, consisting of ex-Senator Henderson, Pres. W. L. Wilson, Prof. Alexander Graham Bell, Pres. J. B. Angell, and Representative Hitt. This committee has prepared a report which was presented at a recent meeting of the board of regents. The concluding lines of this report are as follows:

"The committee does not hesitate to express its warm and decided sympathy with the general purpose of the movement thus made by the associated colleges. The object sought commends itself to us all, and the zeal and ability with which it has been pressed upon our consideration by the very able and distinguished educators and scientists connected with these colleges furnish ample assurance that the consummation of the great and leading object sought by them is only a question of time. The material already collected in the bureaus and departments of the Government furnishes a rich mine of educational wealth that will not be permitted to remain forever undeveloped. This material is now being constantly enriched by the most valuable additions to its present enormous wealth. Already it has invited to the national capital many distinguished scientists, anxious to avail themselves of the superior advantages thus offered for investigation and research.

"Your committee, however, is painfully impressed with the fact that the powers of the Smithsonian Institution as at present organized are scarcely broad enough to embrace the work proposed.. And the committee is equally impressed with the fact that even with enlarged authority its present financial condition would absolutely prevent anything like efficient and creditable performance of the work contemplated.

"It is well known to the members of this board that a great wealth of material—material which would be of immense utility in the successful accomplishment of the purposes indicated by the associated colleges—lies buried in the crypts and cellars of the National Museum.

"If our institution is unable for want of room, as it undoubtedly is, even to place this valuable material on exhibition for the public eye, and as little to arrange it for scientific uses, the problem of providing halls for lectures and meeting the necessary expenditures incident to the work proposed becomes serious and formidable in the extreme. Your committee is not prepared to make definite recommendations to the board for its final or ultimate action. That which is clearly inexpedient to-day may become not only expedient but eminently desirable to-morrow."

No final action was taken by the regents, and the matter will be further considered at a special meeting.

The committee of the Association of American Agricultural Colleges and Experiment Stations and a similar committee from the National Educational Association will hold a joint meeting in Chicago the latter part of February, with reference to securing the cooperation of the two associations in arranging for post-graduate study at Washington.

INTERNATIONAL BOTANICAL CONGRESS.—According to the Journal of Botany, an international botanical congress will be held in Paris in connection with the universal exposition from the 1st to the 10th of October, 1900. An official commission has been organized, among the members of which are M. Prillieux, president, and MM. Guerin and Lutz, secretaries. Among the questions approved by the commission and which will be presented before the congress are: Monograph studies; a discussion of species, hybrids, and crosses; unification of micrometrical measures; and the influence of the nature of soil and host plants on development of fungi. The rules for the congress are given, and it is desired that the commission should receive official notice as soon as possible of any botanists expecting to take part in the congress.

MISCELLANEOUS.—The inaugural lecture of the department of agriculture of the University of Cambridge, England, delivered by Professor Somerville, has been published by the University Press. The subject of the address is, Some aspects of the bearings of education and science on practical agriculture. It points out some of the relations of science to agriculture and the advantages of agricultural education. It will be remembered that the chair of agriculture in the University of Cambridge was endowed for a period of 10 years. It is hoped that it will be the means of increasing the interest in agricultural education in England and the recognition by farmers of the assistance which science and agricultural education can give to agriculture.

PERSONAL MENTION.—Prof. F. Wohltman, of Bonn, who has made quite a study of tropical agriculture in Africa, has again gone to that country, at the request of the Government, to continue his studies in the Cameroon district.

Dr. Max Lehmann, formerly assistant in the experiment station at Möckern, has become agricultural chemist at the Imperial Central Experiment Station at Tokyo.

Prof. Max Barth, director of the experiment station at Colmar, Germany, died recently in his forty-fourth year. His scientific investigations related principally to the culture of grapes and wine making.

Dr. C. Correns has been chosen associate professor of botany at Tubingen.

Dr. J. B. De Toni has become professor of botany and director of the Botanical Garden of the University of Camerino, succeeding Prof. A. N. Berlese, who has been chosen professor of natural science of the Royal Lyceum.

EXPERIMENT STATION RECORD.

VOL. XI. No. 8.

The observations noted in the present number in regard to the presence of leucocytes, or white blood corpuscles, in milk are of interest from the fact that the literature contains very little reference to the occurrence of these bodies in milk, and furthermore from the theory which the author advances regarding their peptonizing action.

Leucocytes are held to be a normal constituent of cows' milk, and are said to be more abundant in cream. These observations are supported by the investigations of Eastes, noted in the preceding number. The latter found that normal milk always contains leucocytes, the number being especially marked during the first week of lactation, when they are accompanied by colostrum corpuscles, and then decreasing until there are only a few. They adhere to the fat globules, which often coalesce, forming conglomerations, and hence they are present in largest numbers in the cream.

The presence of leucocytes in milk is not difficult to account for, since they are always present in the blood, and are formed in unusually large numbers in case of certain diseases or injuries, and accumulate in the region of the trouble. They are able to pass the walls of blood vessels and cells, and in case of any lesion of the mammary gland or udder they would be quite likely to be present and to gain access to the milk.

The paper by Barthel in the present issue attributes to the leucocytes of milk, or an enzym secreted by them, the peptonizing action ascribed by Babcock and Russell, of the Wisconsin Station, to the unorganized milk ferment, galactase. The evidence of this action of the leucocytes does not appear to be supported by any considerable amount of experimental data. It rests mainly on the similarity between galactase and the leucocytes in giving the Storch test with hydrogen peroxid, and in their alleged behavior toward certain anæsthetics. But the white blood corpuscles found in clotted blood have only a slight digestive action, and the work thus far done in introducing blood into sterilized milk fails to show that any marked digestive effect is brought about thereby. Galactase, on the contrary, has been shown to be an active agent in this respect, having a pronounced digestive action on the insoluble proteids of milk, in the absence of bacteria, and forming characteristic decomposition products which distinguish it from trypsin or any unorganized ferment known. The Storch test has not been relied upon as conclusive evidence of the presence of galactase, but only as a convenient test for indicating its presence.

The suggestion that the changes attributed to galactase are traceable directly or indirectly to the leucocytes appears to have very little of the element of probability in it, in view of the convincing work which has been done on galactase; but since leucocytes appear to be a constituent of milk and the action of these bodies is not definitely known, an interesting line of investigation is opened up, which may possibly throw some light on the nature or action of other milk enzyms.

Dairy bacteriologists seem gradually to be conceding the importance of the action of milk enzyms in explaining the proteolytic changes in cheese during ripening. The contention that the process is due entirely to the action of bacteria or other micro-organisms has simmered down to a controversy in which one point after another has been relegated to the background. Little or no new material is being published which affords any additional support to the theory that bacteria are necessary, or that unaided they are capable of inducing the characteristic ripening changes. Lactic-acid bacteria, to which the changes were formerly attributed, are no longer held to play more than an incidental rôle in the process, and it has even been admitted by a most ardent advocate of the bacterial theory that galactase may possibly prepare the casein for the action of the lactic acid bacteria, which then complete the decomposition. In his latest communication Freudenreich goes so far as to say that "for the present we are unable to determine how much of the solvent action on the casein is due to the action of the lactic-acid ferments and how much to the action of the natural milk enzym," and the doubt expressed as to the part played by lactic-acid organisms is enforced by his latest experiments. Others have argued that the lactic-acid bacteria take no real part in the ripening process further than to give it the proper direction, by the conditions which they bring about, and that the true ripening changes and the production of flavor and odor are due to a variety of other forms.

It was quite natural that at the outset the presence of large numbers of bacteria in ripening cheese should suggest their causal relation and set investigation in that direction; but the demonstration that cheese can be made and cured under conditions which preclude the growth of bacteria would seem to demand more satisfactory and convincing evidence than has yet been adduced that their presence is not merely an accident rather than a necessity.

In extent and thoroughness the work of Babcock and Russell surpasses that of any other investigators of the subject, and it has been notable for its broad-mindedness and freedom from bias. It has been a scientific search for the truth, in which the current theories have been given full and unprejudiced consideration. The new theories advanced by them have been founded on systematic investigation, and have been submitted to critical test before giving them to the public. These facts must strengthen conviction in the accuracy of the general theory that enzyms which are inherent in milk play the principal rôle in proteolytic changes in cheese ripening, as reaffirmed in their latest contribution.

Until recently their work was confined to hard cheese (Cheddar), but an extension of their studies to cottage cheese indicates very strongly that here too the digestion of the casein is due chiefly to galactase in the milk, and that bacteria and molds exercise at most very little effect. In fact, the indications are that bacteria of the lactic acid group have no appreciable effect on casein digestion.

Under normal conditions of cheese making a variety of micro-organisms are present, and it is quite probable that a number of different forms take part in the ripening process, the galactase peptonizing the casein, and certain bacteria or molds producing decomposition products in the cheese which give it the characteristic taste, odor, and general appearance. The degree of activity of these different forms depends considerably upon the proportions in which they are present and the conditions which they bring about in the cheese, inhibiting certain forms and rendering it a more advantageous medium for the growth of others. Consequently a knowledge of the essential or desirable ferments and micro-organisms and the best conditions for their growth will place the curing of cheese on a more intelligent and rational basis.

RECENT WORK IN AGRICULTURAL SCIENCE.

CHEMISTRY.

The determination of pentosan-free crude fiber according to J. König, O. KELLNER, F. HERRING, and O. ZAHN (*Ztschr. Untersuch. Nahr. u. Genussmtl., 2 (1899), No. 10, pp. 784–786*).—In connection with a series of feeding experiments the authors studied the accuracy of König's method (treatment in an autoclave with sulphuric acid and glycerin; E. S. R., 10, p. 411). Duplicate determinations by the method were found to agree about as closely as by the Weende method. The amounts of pentosans and nitrogen left in the crude fiber by the König and the Weende methods were compared on a number of samples of steer dung—material which from its nature contains larger quantities of difficultly soluble pentosans and nitrogenous substances than most feeding stuffs. The ash-free and water-free fiber by the König method contained from 2.38 to 3.34 per cent of pentosans, while that obtained by the Weende method contained from 16.08 to 19.81 per cent. The percentage of nitrogen was slightly higher in the crude fiber prepared by the König method.

The results obtained by the König method on straw and a number of samples of steer dung were compared with those obtained by the Weende method, correcting the latter figures for the pentosans found in the crude fiber. The results obtained with the two methods in this way were nearly the same in the case of straws, but differed as much as 2 per cent in the case of the dungs, there being no regularity as to which method gave the higher result.

The authors consider the König method an improvement over the laborious Weende method. Used in connection with the Tollens method for determining pentosans, the pentosan-free and nitrogen-free fiber can be calculated more accurately. The method is recommended for use in digestion and metabolism experiments as being more accurate, rapid, and easier carried out than the Weende method, and as effecting a sharper separation of constituents.

On the application of the law of equilibrium to the formation of oceanic salt beds with special reference to the Stassfurt salt deposits, J. H. VAN'T HOFF and W. MEYERHOFFER (*Ztschr. Physikal. Chem., 27 (1898), pp. 75–93, figs. 6; 30 (1899), pp. 64–88, figs. 5; abs. in*

J[illegible]em. Soc. [*London*], *78* (*1900*), *No. 446*, *II*, *p. 12*).—These two artic[illegible]e the results of a study of the statics of hydrated magnesium c[illegible]and carnallite, with a brief description of the apparatus and m[illegible]s used. This is the beginning of a systematic study of the s[illegible] of the various salts found in sea water, which is considered n[illegible]ry to a clear understanding of the causes producing the Stassfu[illegible]d other salt deposits.

D[illegible]ination of nitrogen in saltpeter, M. SCHMÖGER (*Chem. Ztg.*, *23* (*1899*), *No.* [illegible] *829*).—The author briefly reports comparative tests of the Raab-Böttcher, Ulsc[illegible]varda, and Kjeldahl-Förster methods. All gave results somewhat too low, the g[illegible]st error occurring with the Raab-Böttcher method, the least with the Deva[illegible] method (E. S. R., 9, p. 723). The latter (reduction in alkaline solution with alum[illegible]um-copper-zinc alloy) is considered the best and quickest of the methods.

O[illegible]he determination of nitric acid in water, M. HÖNIG (*Festschrift Tech. Hochsch[illegible] Brünn, Oct., 1899; abs. in Chem. Centbl., 1899, II, No. 24, p. 1032*).

[illegible] the determination of sulphuric acid in the presence of iron, G. WYROUBOFF (*[illegible]l. Soc. Chim. Paris, 3. ser., 21* (*1899*), *No. 24, pp. 1046–1049*).

On the determination of the iodin value, J. LEWKOWITSCH (*Analyst, 24* (*1899*), *Oct., pp. 257-259*).—A statement of some results obtained in comparing Wijs' modification of Hübl's process, using a solution of iodin chlorid in glacial acetic acid, with the original method. The results lead to the conclusion that the original method is perfectly reliable.—G. W. SHAW.

The detection of salicylic acid and benzoic acid in milk, G. BRENSTEDT (*Arch. Pharm., 237* (*1899*), *pp. 170–172; abs. in Ztschr. Untersuch. Nahr. u. Genussmtl., 2* (*1899*), *No. 11, p. 866*).

Method for detecting and determining formaldehyde in free state and in its combination, G. H. A. CLOWES and B. TOLLENS (*Ber. Deut. Chem. Gesell., 32* (*1899*), *No. 15, pp. 2841–2848; abs. in Chem. Ztg., 23* (*1899*), *No. 96, Repert., p. 350*).—The substance to be tested for formaldehyde or methylen is heated for 2 hours on a water bath at 70 to 80° C. with a mixture of 15 cc. hydrochloric acid (sp. gr. 1.19), 15 cc. of water, and an excess of phloroglucin. To the filtrate a little concentrated sulphuric acid is added and the solution heated again. If the phloroglucid is precipitated again it is evident that the hydrochloric acid mixture was not sufficient to decompose the methylen derivatives and the experiment must be repeated, heating the substance with 5 cc. of water and a mixture of 10 to 20 cc. of concentrated sulphuric acid, 10 cc. of water, and phloroglucin.

Detection of nicotin, J. SCHINDELMEISER (*Pharm. Centralhalle, 1899, p. 703; abs. in Chem. Ztg., 23* (*1899*), *No. 98, Repert., p. 361*).—Formaldehyde and concentrated nitric acid gives a rose color to dark red with nicotin.

The analysis of golden sirup, R. BODMER, N. LEONARD, and H. M. SMITH (*Analyst, 24* (*1899*), *Oct., pp. 253–257*).—The writers set forth their method of analysis, and present analyses of 26 samples of "golden sirup," 21 of which are made largely from glucose.—G. W. SHAW.

How to detect adulterants in milk, LEFFMANN and BEAM (*Dairy, 11* (*1899*), *No.* [illegible], *p. 372*).—Qualitative tests are given for the detection of water, coloring matters, antiseptics, and other substances added to milk.

Simplifying the phenylhydrazin test for sugar, A. NEUMANN (*Arch. Anat. u. Physiol., Physiol. Abt., 1899, Sup. pt. 2, pp. 549–552, fig. 1*).

Egg albumin, T. B OSBORNE (*Connecticut State Sta. Rpt. 1898, pp. 317–325*).—This article has been abstracted from another source (E. S. R., 11, p. 309).

Changes in the physical state of proteid bodies (*Arch. Physiol.* [*Pflüger*], *78* (*1899*), *No. 7–8, pp. 315–345, figs. 8*).—A study of a number of proteids by methods of physical chemistry

Studies concerning nucleones, R. T. KRUGER (*Ztschr. Physiol. Chem., 28 (1899), No. 5–6, pp. 530–534*).—The author reports experiments on the nucleon of muscular tissue and milk, with special reference to solubility in salt solutions.

Serum globulin soluble in water, E. MARCUS (*Ztschr. Physiol. Chem., 28 (1899), No. 5–6, pp. 559–575*).—A number of experiments are reported.

Studies on the properties of glutin (gelatin), C. T. MÖRNER (*Ztschr. Physiol. Chem., 28 (1899), No. 5–6, pp. 470–523*).—A large amount of experimental research is reported. The article also contains a bibliography of the subject.

Methylen-glucose, a new glucoside from glucose, formaldehyde and hydrochloric acid, B. TOLLENS (*Ber. Deut. Chem. Gesell., 32 (1899), No. 14, p. 2585; abs. in Chem. Ztg., 23 (1899), No. 88, Repert., p. 311*).

Investigation of arabic acid from sugar beets, VOTOČEK and SEBOR (*Böhm. Ztschr. Zuckerind., 24 (1899), p. 1; abs. in Chem. Ztg., 23 (1899), No. 88, Repert., p. 311*).

The saccharification of starch, POTTEVIN (*Ann. Inst. Pasteur, 13 (1899), No. 8, p. 665; abs. in Chem. Ztg., 23 (1899), No. 84, Repert., p. 302*).—A chemical study of the process.

Inorganic ferments: Platinum catalysis and the chemical dynamics of hydrogen peroxid, G. BREDIG and R. MÜLLER VON BERNECK (*Ztschr. Physikal. Chem., 31 (1899), pp. 258–353, figs. 3*).—The analogy of certain reactions induced by inorganic substances to true fermentation is pointed out.

A method for collecting and analyzing intestinal gases and those due to fermentation, N. ZUNST (*Arch. Anat. u. Physiol., Physiol. Abt., 1899, No. 5–6, pp. 579–586, fig. 1*).—The author describes in detail an apparatus for the measurement and analysis of these gases.

Report of the Chemical Control Station in Christiania, Norway, 1898, F. H. WERENSKIOLD (*Aarsber. Offent. Foranst. Landbr. Fremme, 1898, pp. 106–151*).

BOTANY.

The flowering and pollination of Indian corn, W. R. LAZENBY (*Proc. Soc. Prom. Agr. Sci., 1898, pp. 123–129*).—The author reports observations on the flowering of corn, the studies having been made on a number of varieties for a considerable time. Among the varieties under observation were 5 of dent, 4 of flint, and 4 of sweet corn. The number of flowers upon a stalk of corn is found to vary widely in the same variety as well as to show marked differences. An estimate was made of the average number of pistillate and staminate flowers of different kinds of corn. The ratio of pistillate to staminate flowers in dent corn was 1:6; in flint corn, 1:7, and in sweet corn, 1:3.5. The author investigated the approximate number of pollen grains and ovules in the 3 different classes of corn and gives the ratio in round numbers. From the figures given there is shown to be a great excess of pollen. The relation between the time of shedding pollen and the appearance of silk is stated, in which it is shown that in a large majority of cases the pollen had begun to be shed before the silk appeared. It is stated that in several cases where pistillate flowers were found associated with the staminate ones that the pistillate flowers in every case developed first. As a rule, however, the discharge of pollen is said to begin from 2 to 5 days before the silk appears and the length of time in which the pollen is discharged varies from 5 to 10 days, dependent upon the variety, temperature, sunshine, and dryness of the weather.

From measurements of the rate of growth of a number of plants, it is stated that a plat of Livingston dent was in full blossom 60 days from the date of planting and the stalks averaged a little over 8 ft. in height, making the rate of growth of these plants a little in excess of 1.5 in. per day from the date of planting.

The author's conclusions are that many if not most of the common varieties of Indian corn require cross pollination, being partially or wholly incapable of producing a fertile ear when limited to pollen from the same stalk. The principal reason for this is that the pollen matures before the stigmas are receptive. Under favorable circumstances, there is a great excess of pollen produced and corn is usually well pollinated in fields of considerable size, owing to the duration of the period of flowering. Imperfect ears of corn are not due to imperfect pollination alone but to imperfect ovules as well.

Fertilization of the muskmelon, F. W. Rane (*Proc. Soc. Prom. Agr. Sci., 1898, pp. 150, 151*).—The muskmelon is generally reported as being either monœcious or diœcious but the author reports that in examining what were considered pistillate flowers well developed stamens were found. On closer examination there were found not only well-developed stamens but the stamens were prolific with pollen. The same varieties were later examined out of doors and found not to vary in the least. Of a number of varieties examined the flowers of 84 proved to be perfect and only 11 imperfect or monœcious. Many flowers were covered just previous to opening and then pollinated with their own pollen with the result that many specimens were developed which were comparatively self-fertile.

Influence of light on the formation of active proteid materials in plants, W. Palladin (*Rev. Gén. Bot., 11 (1899), No. 123, pp. 81–105; also briefly noted in Compt. Rend. Acad. Sci. Paris, 127 (1899), No. 6, pp. 377–379*).—In a previous work (E. S. R., 8, p. 843) the author has shown the correlation existing between the respiratory energy of plants and the amount of active nitrogenous compounds which are formed. The cell products are classified by the author into dead products, of which the cell membrane, starch, crystals of calcium oxid, aleuron grains, crystalloids, and proteids dissolved in cell sap are the principal ones, and living or active products, such as protoplasm, nucleus, chlorophyll grains, and leucites. Some of the conditions under which the latter class of products are formed are shown in the present paper

The experiments, which are described in considerable detail, were mostly made upon etiolated bean seedlings grown in 5 and 10 per cent solutions of sugar. After about 6 days, plants which had been kept in darkness were compared with those grown in the light for the same time. It was found that the leaves assimilated in the light three times as much saccharose as in darkness. In the presence of saccharose the synthesis of proteid material takes place much more energetically in the light than in darkness. For 100 gm. of fresh leaves the nitrogen in the proteid substances increased 248 mg. in the light as compared with 97 mg. in darkness. The regeneration of proteids takes place much more actively in the blue portion of the spectrum than in the yellow. The presence of an abundant carbohydrate reserve and the action of light are indispensable to the normal formation of nitrogenous substances in living leaves.

The respiration of the plants in light and darkness was compared. It was shown that when cultivated in sugar solutions, leaves which are exposed to the light give off more than twice as much carbon dioxid as those cultivated under the same conditions but kept in the dark.

The author states that there is a correlation between the carbon dioxid given off and the nitrogen content of the proteids, and in each series of experiments when comparisons were made between leaves exposed to the light and those kept in darkness, the proportion of carbon dioxid to nitrogen was constant.

Effect of electric light upon the tissues of leaves, W. W. ROWLEE (*Proc. Soc. Prom. Agr. Sci., 1898, pp. 50–58, pls. 2*).—In connection with studies of the general effect of electric light upon growth and maturation, investigations were undertaken to determine what, if any, effect electric light has upon the tissues of plants. When the arc light is used it has been known for sometime that some plants are seriously injured while others are little or not at all affected. Experiments were conducted by the author to ascertain the change in structure of the tissues of plants susceptible to the influence of electric light, and the difference in leaf structure that enables one group of plants to withstand the electric light while another in the same condition would be seriously injured or totally destroyed.

Four species of plants were selected for special study, 2 of which showed an immediate injury under the light, and 2 others which were apparently not at all affected. The ones selected to represent the plants susceptible to light were heliotrope and coleus; and those not susceptible, *Ficus elastica* and a species of Coronilla. The plants were divided into 2 groups, one of which was kept under conditions of normal light and darkness while the other was placed about 1 meter from a naked arc light in such a position as to receive the direct rays of light. The leaves were examined before and after exposure to the light and the differences noted. The tissues of the leaves which were not perceptibly affected by the light were not altogether uniform, and were developed in such a way as to retard too rapid transpiration. In the case of the leaves affected by the light their structure was quite uniform and the cell walls comparatively thin. The immediate effect of the light upon these leaves is shown by the upper epidermis, the cells of which completely collapse. After 8 hours subjection to an unscreened arc light the epidermis on both heliotrope and coleus leaves had collapsed and the epidermal hairs exhibited a tendency in that direction. This injurious effect may be prevented by the interposition of a screen of ordinary glass. The author thinks the effect is produced by the destruction of the protoplasm itself and not by any increased activity in transpiration.

Plant relations; A first book of botany, J. M. COULTER (*New York: D. Appleton & Co., 1899, pp. VII + 264, figs. 206*).

Recent additions to systematic agrostology, F. LAMSON-SCRIBNER (*U. S. Dept. Agr., Division of Agrostology Circ. 15, pp. 10, figs. 5*).—This circular is supplemental to the translated edition of Hackel's "True Grasses," which appeared in 1890. Recent important additions to the literature and descriptions of new genera have been cited in Hackel's supplement to the above work The recently-described genera and important changes in the nomenclature not published in the supplement warrant their presentation at this time for the use of American students of grasses.

New species of North American grasses, F. LAMSON-SCRIBNER (*U. S. Dept. Agr., Division of Agrostology Cir. 16, pp. 6, figs. 2*).—The following new species of grasses are described by the author: *Puccinellia simplex, Poa curtifolia,* and *Dactyloctenium australiense;* and *Panicum orinum, P. inflatum, P. thurowii,* and *P. octonodum* are described by the author, in conjunction with J. G. Smith. A number of new combinations of names are also given.

Some ecological notes on Iowa grasses, L. H. PAMMEL (*Proc. Soc. Prom. Agr. Sci., 1898, pp. 204–211*).—The author gives the distribution of Iowa grasses as related to ecological factors from which it appears that there is but a single species of grass which is adapted to salt marshes or alkali soils. Among the Xerophytic grasses which are adapted to growth in rather dry soils 17 species are enumerated. A striking peculiarity of all the Xerophytic grasses is that they grow in bunches. The leaves are so constructed that transpiration is reduced to a minimum.

Of the third group, termed Mesophytic grasses, 20 species are enumerated which are adapted to forest and prairie regions. The Hydrophytic grasses, or those which are unable to withstand the injurious effect of dry soil and weather, are represented by 11 species. A final class, which the author has termed Agragrian, embraces those species which are not limited to any peculiar condition of soil or climate, but have adapted themselves to a variety of conditions. Twelve such species are enumerated, this list including many of the more common weed-like grasses.

A synoptic conspectus of the native and garden species of Aconitum of North America, K. C. DAVIS (*Minnesota Bot. Studies, 2. ser., 1899, pt. 3, pp. 345–352*).

A synoptic conspectus of the native and garden Aquilegias of North America, K. C. DAVIS (*Minnesota Bot. Studies, 2. ser., 1899, pt. 3, pp. 331–343*).

The genus Psalliota, C. G. LLOYD (*Mycological Notes, 1899, No. 4, pp. 25–30*).—The author describes a number of new species of this genus, and gives a synopsis and notes on the species recorded from this country. Psalliota has been adopted by the author as the name for the genus Agaricus.

Some new species of Aspergillus, C. WEHMER (*Bot. Centbl., 80 (1899), No. 12, pp. 449–461, fig. 1*).—*Aspergillus varians, A. minimus,* and *A. ostianus* are described and their relationships discussed.

Notes on the fertilization of flowers, W. M. MUNSON (*Proc. Soc. Prom. Agr. Sci., 1898, pp. 176–183*) —Notes are given on some of the more salient points concerning the passage of the male nucleus from the pollen grain to the embryo sac, the idea being to bring together the available data for use in future work. Notes are given on the character of the pollen grain, on its germination, and the growth of the pollen tube, and on the method of entering the nucellus. Some of the secondary effects of pollination are pointed out and statements given relative to the amount of pollen required for fertilization.

On the functions of aerial roots, A. NABOKICH (*Bot. Centbl., 80 (1899), Nos. 9, pp. 331–340; 10, pp. 376–384; 11, pp. 423–432; 12, pp. 471–477; 13, pp. 503–510, pls. 2*).

The distribution of lithium in plants, E. TSCHERMAK (*Ztschr. Landw. Versuchw. Oesterr., 2 (1899), pp. 560–571; abs. in Chem. Ztg., 23 (1899), No. 102, Repert., p. 381*).

Aldehyde in green leaves, J. REINKE and E. BRAUNMÜLLER (*Ber. Deut. Bot. Gesell., 17 (1899), pp. 7–12; abs. in Jour. Roy. Micros. Soc. [London], 1899, pt. 5, p. 499*).—A number of series of experiments on different plants to determine the effect of light on the amount of aldehyde contained in green leaves is reported, in which the results secured were not uniform, but in general it is claimed that depriving plants of light caused a distinct diminution in the amount of aldehyde present. The authors conclude that aldehyde is probably not the first product of assimilation, but whatever the first product may be, it is in the majority of cases first condensed into sugar.

Cane sugar in plants, E. SCHULZE (*Ztschr. Phys. Chem., 27 (1899), pp. 267–291; abs. in Jour. Roy. Micros. Soc. [London], 1899, pt. 6, p. 612*).—The author reports the wide distribution of cane sugar in ripe seeds of plants, although in many cases it occurs in very small quantities. It has been observed in the seeds of a number of conifers. Cane sugar is considered of importance as a reserve material in the process of germination, but as it increases as growth proceeds it probably fulfills other uses. Accompanying cane sugar there are frequently present in large quantities other soluble sugars capable of inversion.

Concerning reserve protein, J. GRUSS (*Wchnschr. Brau., 16 (1899), No. 41, pp. 532–534, pl. 1*).

On the chemistry of chlorophylls, L. MARCHLEWSKI (*Jour. Prakt. Chem., n. ser., 60 (1899), pp. 91–96*).

The physiology of tuber formation, H. VÖCHTING (*Jahrb. Wis. Bot. [Pringsheim], 34 (1899), No. 1, pp. 1–148, pls. 5, figs. 9*).—The results of experiments and studies on the production of organs modified to perform vicarious functions are reported. The structure and physiology of tuber formation is given for normal and special conditions. The subjects of experiment embraced *Oxalis crassicaulis*, *Boussingaultia baselloides*, *Thladiantha dubia*, *Gloxinia speciosa*, *Raphanus sativus*, *Helianthus tuberosus*, *Sedum maximum*, *Apios tuberosa*, and several varieties of potatoes.

A case of atavism in the potato, S. RHODIN (*Tidskr. Landtmän, 20 (1899), No. 12, pp. 207–210*).

On the effect of acid gases on plants, WIELER (*Verhandl. Naturhist. Ver. Preuss. Rheinlande, 56 (1899), No. 1, pp. 44–49*).—The effect of fumes and vapors carrying acid gases as shown by studies of foliage and wood are given.

The toxic effect of ammonium salts, S. TAKABAYASHI (*Imp. Univ. Col. Agr. [Tokyo] Bul., vol. 3, No. 3, p. 265; abs. in Ann. Agron., 25 (1899), No. 6, p. 301*).

Electrolytic dissociation and its toxic effect, J. F. CLARK (*Jour. Phys. Chem., 3 (1899), pp. 263–317*).

The influence of inorganic salts on the conidia formation of Aspergillus niger, A. YASUDA (*Bot. Mag. [Tokyo], 13 (1899), No. 149, pp. 85–90*).

Formation of conidia in fungi, C. WERNER (*Die Bedingung der Conidien-bildung bei einigen Pilzen. Frankfort-on-the-Main, 1898, pp. 48, figs. 55; abs. in Jour. Roy. Micros. Soc. [London], 1899, No. 4, p. 420*).—The author distinguishes in *Nectria cinnabarina* three forms of conidia. The first, which he calls aquatic, may be abstricted in an irregular way from all the hyphæ. The second are aerial conidia formed on simple or branched erect conidiophores; and the last group, those formed on branched crowded hyphæ, have often a strong developed stroma, their form being always narrowly elliptical. The first kind are formed in fluid media, the second on a nutrient agar or gelatin, and the third are produced when the substratum is drier than the surrounding air. The formation of the conidia is found to decrease as the concentration of the medium is increased. In *Volutella ciliata* abundance of nutriment and low transpiration induces the formation of tufts of conidiophores, while if the nutriment is deficient and transpiration low, simple conidiophores are produced.

Nitragin and the nodules of leguminous plants, MARIA DAWSON (*Phil. Trans. Roy. Soc. London, ser. B, 192* (*1899*), *pp. 1–28, pl. 1*).—This is the complete paper, a résumé of which has already appeared (E. S. R., 11, p. 25). An extensive review of literature is given and the author's experiments are described in detail.

Experiments with Alinit, W. KRÜGER and W. SCHNEIDEWIND (*Landw. Jahrb.*, *28* (*1899*), *No. 3–4, pp. 579–591*).—Details are given of pot, bed, and field experiments with Alinit. No benefit whatever resulted from its use on sugar beets, potatoes, oats, or mustard, the crops experimented with.

Influence of organic material on the action of nitrifying organisms, S. WINOGRADSKY and V. OMÉLIANSKY (*Arch. Sci. Biol.* [*St. Petersburg*], *7* (*1899*), *No. 3, pp. 233–271*).

ZOOLOGY.

Results obtained by bacteriological methods of fighting susliks (Spermophilus rufescens) (*Selsk. Khoz. i Lyesov., 192* (*1899*), *Mar., pp. 583–618*).—In experiments conducted for the purpose of determining the value of different disease germs in destroying susliks, cultures were made of the germs of chicken cholera, mouse typhus of Löffler, mouse dysentery of Danisch, Merezkhovski's suslik bacillus, and the rat bacillus of Isachenko.

The method of infecting the susliks with cultures of various germs may be described as follows: Wheat was heated in water up to the boiling point, then removed and thoroughly dried in the sun. It was afterwards placed in sacks and kept until needed for use in the field. The wheat was infected with the pathogenic germs by soaking it, in the field, in vessels containing the cultures of the germs. As soon as the wheat was thoroughly saturated, it was used for infecting the burrows, a small quantity being placed in each burrow. During laboratory experiments with these disease germs upon susliks, it was found that the virulence of the bacilli could be increased to a considerable extent by passing cultures through the organism of susliks. The degree of virulence of cultures of chicken cholera when passed through the susliks was highest on the fifth and sixth days; of the Löffler bacillus, on the ninth day.

The bacilli of mouse typhus and mouse dysentery were found very effective in the destruction of susliks. The bouillon cultures of the pathogenic germs were prepared on the day previous to use. As soon as the wheat had been soaked in the culture, a tablespoonful of it was immediately placed in a burrow. Experiments in the field demonstrated that if no green herbage is to be found and if every burrow is infected, the bacilli of chicken cholera or mouse typhus may be relied upon for favorable results in destroying susliks. It was found, however, that when some burrows were infected and others left uninfected, the disease was not transmitted from the susliks of infected burrows to those of the uninfected burrows except to a limited extent.—P. FIREMAN.

The life history and means of combating the tobacco nematode (Heterodera radicicola) in Deli, J. VAN BREDA DE HAAN (*Meded. 'S Lands. Plantentuin, 1899, No. 35, pp. 68, pls. 3*).—In this article the author gives detailed descriptions of the egg, larval, and adult forms of a nematode which was found to be very injurious to tobacco in Deli. An account is given of the life history, habits, systematic position, and distribution of the nematode, and the internal and external appearance of the galls caused by the activity of the nematodes upon tobacco roots are described and figured.

The results of the author's work may be summarized as follows: The nematode which was found parasitic upon the roots of the tobacco plant is considered to be *Heterodera radicicola.* This nematode occurs upon many other plants, even in virgin forest land. When the nematode penetrates the roots of tobacco, a gall formation results, which modifies the structure of the roots, producing an increase of parenchyma cells and a number of so-called giant cells. The eggs are found inside of the gall tissue, and the young, after hatching in this situation, may eventually emerge from the galls and can live for some time outside. It is probable that Heterodera can also live saprophytically. The destruction of the root tissue hinders the normal development of the plants by preventing the proper amount of water in the parts of the plants above ground. As soon as the galls reach a certain age, they may split open and thus allow other organisms to enter and cause the premature death of the plants. Culture methods may be adopted which will prevent in a large degree the distribution of Heterodera. When the soil is once infested with these nematodes, it can be freed from them by the use of gasoline and other chemical substances.

Nature's foresters, E. H. FORBUSH (*Massachusetts State Bd. Agr. Rpt. 1898, pp. 279–294*).—This paper gives a popular account of the activity of the various birds, mammals, and insects in scattering the seeds and nuts of different forest trees as well as in destroying buds and branches of trees.

An observation on the feeding habits of the chipping sparrow, C. M. WEED (*Proc. Soc. Prom. Agr. Sci., 1898, pp. 109–111*).—An abridged form of New Hampshire Station Bulletin 55 (E. S. R., 8, pp. 726, 727).

Animals injurious to sugar beets, W. HERZOG (*Monographie der Zuckerrübe. Hamburg: L. Voss, 1899, pp. 144–165*).—In his monograph of the sugar beet the author devotes one section to a discussion of the animal enemies of the sugar beet. Among nematodes the author gives consideration to *Heterodera schachtii, Dorylaimus condamnus, D. incertus,* and *D. makrodorus.* The nematodes are parasitized by several species of fungi.

Biological and economic notes are also given on numerous species of insects, centipedes, and earthworms.

An epizooty of Strongylus strigosus in rabbits in Scotland, F. V. THEOBALD (*Jour. Southeast. Agr. Col., Wye, 1899, No. 8, pp. 60–62*).—This nematode is reported as having caused the death of large numbers of rabbits by perforating the walls of the stomach.

Red cats and disease, R. HENRY (*Trans. and Proc. New Zealand Inst., 31 (1898), pp. 680–683*).—The raising of cats to assist in the extermination of rabbits gives some economic importance to these animals. During several disastrous outbreaks of distemper among cats it was observed that cats of a red color were almost entirely immune to the disease.

FERMENTATION—BACTERIOLOGY.

Alcoholic fermentation without yeast cells, E. BUCHNER and R. RAPP (*Ber. Deut. Chem. Gesell., 32 (1899), pp. 2086–2094; abs. in Jour. Roy. Micros. Soc. [London], 1899, pt. 6, pp. 622, 623*).—The authors' conclusions, based upon a large number of experiments, are quoted as follows:

(1) When yeast which has been well triturated with kieselguhr and quartz sand, is fractionally filtered under a pressure of 60 kg. per sq. cm., the liquid which runs through first is far less active than the later fractions, the most active portion being obtained by a second trituration and filtration without the addition of more water. From 1,200 gm. of yeast with the gradual addition of 65 cc. of water, 730 cc. of active extract may be obtained. When, however, the extract is filtered through biscuit porcelain, the first 20 cc. are much more active than any of the subsequent fractions.

(2) Fermentation takes place equally readily with solutions containing from 15 to 30 per cent of sugar; in such case toluene is added and the temperature kept at 23° C. When sugar is not present, very little fermentation takes place, the maximum amount of carbon dioxid evolved from 20 cc. of extract, after 40 hours, being 0.06 gm., and after 88 hours, 0.1 gm.

(3) Starch itself is not fermented by the extract, but "soluble starch" and dextrins of various origins are readily fermented.

(4) Glucose and fructose are fermented at practically the same rate, both by yeast extract and by fresh Munich bottom yeast. This conclusion is, however, not in accord with statements made by other authorities.

(5) The previous irregularities noticed on the addition of potassium arsenite to the yeast extract are probably to be explained by the proteids in the extract protecting the zymase from the action of the arsenite; as it has been found that the dilution of the extract with water, in the presence of 2 per cent of arsenite, practically stops fermentation, whereas dilution with blood serum or liquids rich in proteids, or even sugar solution, in the presence of the same amount of arsenite, retards the fermentation to a slight extent only. Glucose can also be fermented to a certain extent by yeast extract in the presence of arsenite.

Bacteria in flowers, D. FREIRE (*Compt. Rend. Acad. Sci. Paris, 128 (1899), No. 17, pp. 146–149*).—The author reports a number of experiments in which cultures were made in both liquid and solid media from the carpels, stamens, stigmas, and anthers of a number of cultivated flowers.

From the anthers of *Hibiscus rosa sinensis* a new species was cultivated to which the name of *Micrococcus cruciformus* was given. From the corolla of the Rothschild rose, *Leptothrix ochracea* was secured, and from a 100-leaved rose. 2 organisms, *Streptococcus pyogenes* and a new organism, *Bacillus gallicus*, were isolated. From a cardinal flower (*Ipomœa quamoclit*) 2 species were isolated, the first having the characters of *Micrococcus salivarius pyogenes* and the second was recognized as *Spirillum plicatile*. Cultures made from the flowers of the peach showed the presence of *Bacillus pyocyaneus*

The author states that in these cultures the pigments very frequently were of the same color as the flower or part of the flower from which they were taken, and he is disposed to believe that there is some relationship between the two. It was further stated that these different micro-organisms in their cultures gave off odors analogous to those of the flowers from which they were taken. For such organisms he proposes the name Osmogenic.

Bacteria in agriculture, A. J. McClatchie (*Pacific Rural Press, 59 (1900), No. 3, pp. 36, 37*).—A popular paper.

Bacteriology, A. G. Humphrey (*Trans. Illinois State Hort. Soc., 1898, pp. 235–239*).—The author discusses the significance of bacteriology in questions of human and animal sanitation and in relationship to soil problems and fermentation processes.

Bacteria; especially as they are related to the economy of nature, to industrial processes, and to the public health, G. Newman (*London: John Murray, 1899, pp. XVI + 351; rev. in Nature, 60 (1899), No. 1558, p. 434*).

Germs and their work in fermentations, J. Nelson (*New Jersey Stas. Rpt. 1898, pp. 248–287, pls. 5*).—A popular discussion is given of the subject of bacteria and fermentations brought about by their action. This article in an abridged form was published as Bulletin 134 of the station (E. S. R., 11, p. 125).

Bacteria in sanitation; their uses in agriculture, the arts, and industries, L. H. Pammel (*Iowa State Agr. Soc. Rpt. 1898, pp. 52–56*).—A popular article on the subject of germ diseases and of the activity of bacteria in other fields in relation to agriculture.

On the making and application of pure cultures, L. F. Rosengren (*Meddel. K. Landtbr. Styr., 1899, No. 56, pp. 38–44*).

On some new methods and apparatus for the bacteriological laboratory, J. Nelson (*New Jersey Stas. Rpt. 1898, pp. 243–248, pls. 3*).—Brief notes are given on fixing films to cover glasses, dilution methods for milk, counting colonies grown in tube cultures, filling culture tubes with media, a sterile water tank, a sterile milk container and pasteurizing can, dust-proof filtering bulbs and their application, universal pasteurizing and sterilizing apparatus, and on rubber caps for culture tubes.

Three newly found lactic-acid bacteria in ensiled beet chips, E. Weiss (*Jour. Landw., 47 (1899), No 2, pp. 141–161*).—Three different forms of bacteria were found, all of which produced lactic acid. These the author calls *Bacterium pabuli-acidi* I, II, III.

A sugar bacterium, H. Marshall Ward and J. R. Green (*Proc. Roy. Soc. [London], 64 (1899), No. 414, pp. 65–84*).—Studies are reported of a species of Bacterium which is associated with a yeast, the two forming a sort of excrescence on sugar cane. These clumps are said to be quite like those of the ginger-beer plant, and are used in making a fermented effervescent drink. The organism will ferment only cane and allied sugars and will not grow in acid media. Its behavior on a number of media is given, and the relation of the two organisms is discussed. There was at first thought to be a symbiosis between the yeast and the bacteria, but subsequent investigations seem to indicate that the bacterium is a saprophyte living at the expense of the nitrogenous excreta of the yeast. It is not at all parasitic, the yeast never being injured by its presence.

A soil bacillus of the type of De Bary's B. megatherium, W. C. STURGIS (*Proc. Roy. Soc. [London], 64 (1899), No. 409, pp. 340–342*).—The author describes a bacillus which was isolated from clayey and gravelly soil at a depth of about 1 inch. It is said to be straight or slightly curved, 3.4 to 7.7 μ by 1.2 to 1.5 μ in size, and occurs as isolated rods or in long chains.

The characteristics of the organism in different media and reaction toward heat, oxygen, etc., are given, and it appears to have affinities with a number of species. It seems quite near the *B. megatherium* described by De Bary and further studies may show them identical, in which case added interest will be given the subject as showing remarkable variation in the species.

Changes produced in the molecular concentration and electric conductivity of culture media produced by the growth of bacteria, G. N. SMITH (*Jour. Expt. Med., 4 (1899), No. 2, pp. 235–243*).

Decomposition of cement by bacteria, A. STUTZER and R. HARTLEB (*Ztschr. Angew. Chem., 1899, pp. 402–403; abs. in Jour. Chem. Soc. [London], 76 (1899), No. 441, II, p. 505*).

Quick vinegar bacteria, F. ROTHENBACH (*Wchnschr. Brau., 16 (1899), No. 8, pp. 100–102; abs. in Jour. Soc. Chem. Ind., 18 (1899), No. 4, p. 387*).

The nutrition of yeasts, I, A. L. STERN (*Jour. Chem. Soc. [London], 75 (1899), No. 436, pp. 201–211*).

The fermentation of raffinose by Saccharomyces pombe, H. GILLOT (*Bul. Soc. Belge Micros., 25 (1898–99), pp. 29–44*).

Ferments, E. ESTAUNIÉ (*Les ferments. Paris: Perrin & Co., 1899, pp. 353*).

The soluble ferments and fermentation, J. R. GREEN (*London and New York: The Macmillan Co., 1899, pp. XIV, 480*).

Diastase or soluble ferments, H. COUPIN (*Les diastases ou ferments solubles. Paris: Lechevalier, pp. 20, figs. 17*).

Fermentation without yeast (*Sci. Amer., 8 (1899), No. 25, p. 407*).

Recent researches on the proteolytic diastase of yeast extract, L. GERET and M. HAHN (*Ber. Deut. Chem. Gesell., 31 (1898), p. 2335; abs. in Bul. Soc. Chim. Paris, 22 (1899), No. 9, pp. 431, 432*).

The saccharification of starch by means of malt diastase, H. POTTEVIN (*La saccharification de l'amidon par la diastase du malt. Thesis, Sceaux, 1899, pp. 67*).

Concerning the glucocids and enzym found in certain species of Spiræa, M. W. BEIJERINCK (*Centbl. Bakt. u. Par., 2. Abt., 5 (1899), No. 12, pp. 425–429*).

On the presence in the animal organism of a soluble ferment which reduced nitrates, E. ABELOUS and E. GÉRARD (*Compt. Rend. Acad. Sci. Paris, 129 (1899), No. 1, pp. 56–58; 3, pp. 164–166*).

On the presence of oxidizing ferments in some phænogams, N. PASSERINI (*Nuovo Gior. Bot. Ital., 6 (1899), pp. 296–322*).

Ferments in wine diseases, J. LABORDE (*Séances Soc. Sci. Phys. et. Nat. Bordeaux, 1898, pp. 149–155*).—The bitterness of wine, or "casse," is said to be caused by ærobic organisms either completely or facultatively, and turned wines are due to either ærobic or anærobic organisms.

Studies of the Borscht or Barszcz fermentation of red beets, S. EPSTEIN (*Arch. Hyg., 36 (1899), No. 2, pp. 145–157*).

The action of formaldehyde on enzyms and on certain proteids, C. L. BLISS and F. G. NOVY (*Jour. Expt. Med., 4 (1899), No. 1, pp. 47–80*).

METEOROLOGY.

Meteorological observations, J. E. OSTRANDER and A. C. MONAHAN (*Massachusetts Hatch Met. Buls. 130, 131, 132, pp. 4 each*).—Summaries of observations on pressure, temperature, humidity, precipitation, wind, sunshine, cloudiness, and casual phenomena during October, November, and December, 1899. The general character of the weather of each month is briefly discussed and the December bulletin gives a summary for the year. The principal data in this summary are as follows:

Pressure[1] (inches).—Maximum, 30.92, January 2; minimum, 29.10, December 24; mean, 30.011. *Air temperature*[2] (degrees F.).—Maximum, 93, June 5; minimum, —21.5, January 2; mean, 46.8; mean sensible (wet bulb), 43.7; annual range, 114.5; maximum daily range, 47, April 29; minimum daily range, 4.5, March 15, November 15, December 5; mean daily range, 21.2. *Humidity.*—Mean dew point, 40.1; mean force of vapor, 0.420; mean relative humidity, 75.6. *Precipitation.*—Total rainfall and melted snow, 41.49 in.; number of days on which 0.01 in. or more rain or melted snow fell, 110; total snow fall, 52 in. *Weather.*—Mean cloudiness observed, 54 per cent; total cloudiness recorded by sun thermometer, 2,210 hours, or 50 per cent; number of clear days, 81; number of fair days, 139; number of cloudy days, 135. *Bright sunshine.*—Number of hours recorded, 2,245, or 50 per cent. *Wind.*—Prevailing direction, W., SW.; total movement, 47,110 miles; maximum daily movement, 449 miles, February 13; minimum daily movement, 4 miles, December 18; mean daily movement, 129 miles; mean hourly velocity, 5.2 miles; maximum pressure per square foot, 22 lbs., or 66 miles per hour, March 7, N. E. *Dates of frosts.*—Last, May 4; first, September 14. *Dates of snow.*—Last, April 16; first, November 12.

Meteorological observations, 1890–1898, E. SIXT (*Bol. Inst. Agr. São Paulo, 10 (1899), No. 7, pp. 546, 547*).—This is a summary by months (with averages for each year) of observations on atmospheric pressure, temperature, humidity, precipitation, cloudiness, and direction of wind.

On the mechanics of cyclones, BJERKNES (*Chem. Ztg., 23 (1899), No. 79, p. 833*).—A brief reference to a paper presented before the German Society of Naturalists and Physicians at its meeting September 17–23, 1899.

WATER—SOILS.

Investigations on the influence of salts on soil moisture, E. WOLLNY (*Vrtljschr. Bayer. Landw. Rathes, 4 (1899), No. 4, Sup. 1, pp. 137–479, fig. 1*).—This is a contribution from the agricultural experiment farm of the technical high school in Munich. Previous work along this line is briefly reviewed and experiments by the author during a number of years are reported in detail and discussed in their practical bearing. The apparatus used, a kind of lysimeter, is described and illustrated. This consists of a zinc box 30 cm. deep and 20 cm. square, closed at the bottom with a funnel for collecting the drainage water. The lysimeter is inclosed in a double-walled wooden jacket which is filled with humus soil. In the experiments reported sodium chlorid, potassium chlorid, ammonium chlorid, calcium chlorid, magnesium chlorid, sodium nitrate, potassium sulphate, sodium sulphate, ammonium sulphate, magnesium sulphate, potassium carbonate, monopotassium phosphate, and monocalcium phosphate were used at rates of 445 to 891 lbs. per acre.

The general conclusion was reached that the application of soluble salts increases the water supply of the soil and lessens the amount of water transpired by plants, but that these effects of the salts are of no benefit to the plant, because the increased growth due to the application of the salts uses more water than the soil gains as a result of the application of the salts. Moreover, in dry weather, when the moisture of the soil is of most importance, the soil solutions are likely to become so concentrated by evaporation as to partially or completely prevent the taking up of water by the roots of plants. It appears, therefore, that the benefit as regards soil moisture which on theoretical grounds would be expected from the application of soluble salts to the soil is not, as a rule, realized in practice.

---

[1] Reduced to freezing and sea level.

[2] In ground shelter, 51 ft. below level of other instruments.

Some physical and chemical peculiarities of arid soils, E. W. HILGARD (*Proc. Soc. Prom. Agr. Sci. 1898, pp. 70–76*).—This article summarizes the results of investigations at the California Station given in U. S. Weather Bureau Bul. 3 (E. S. R., 3, p. 276), as well as those of more recent studies along the same lines, which have been reported in publications of the station (E. S. R., 10, pp. 220, 225). The practical bearing of these results is briefly discussed.

The main points brought out by the investigations are as follows: The soils of the arid region are as a rule sandy, silty, or pulverulent, and rarely contain clay. Kaolinization and the subsequent formation of clay goes on in them to a very limited extent, being partially replaced by the formation of zeolitic compounds. There is practically no difference between soil and subsoil. The "sand" of such soils includes some quartz particles, but is made up largely of particles of other rock minerals. The soils are as a rule richer in plant food than soils of humid regions, this being especially true of lime (12–14 to 1), magnesia, and potash (3–4 to 1). The humus content is smaller, but the amount of nitrogen is about the same, since the humus of arid soils is from 3 to 5 times as rich in nitrogen as that of humid regions. Nitrification is also more active and the nitrates are not leached out.

"The occurrence of 'alkali' salts in the soils of the arid regions is independent of either present or former marine conditions. The salts are the educts of the soil from the weathering process, and in consequence of deficient rainfall have failed of being leached into the subdrainage. They very commonly contain notable amounts of water-soluble potash salts, also nitrates, and frequently alkali phosphates. Aside from these water-soluble ingredients, alkali soils always contain large amounts of acid-soluble plant food.

"The presence of alkali carbonates (usually the sodic salt) acts most injuriously, not only in being directly corrosive of the bark of roots and stems, but also in so deflocculating the soil as to render tillage and drainage impossible. This can be remedied by the transformation of the sodic carbonate into sulphate, by means of land plaster in the presence of water; soils so treated become profusely productive, unless overcharged with sodic salts.

"Outside of the axes of valleys, the alkali salts are usually contained within the first 4 ft. from the surface down. Within this limit they migrate up and down according to the moisture conditions, but are apt to accumulate particularly at the average depth to which the annual rainfall penetrates. We can therefore ascertain, by the examination of a 4-ft. column of soil, the total amount of salts which, under favorable conditions, may either accumulate within 6 in. of the surface or be more or less evenly distributed through the soil column. We can thus determine beforehand the practicability of reclaiming such lands for cultivation under existing economic conditions, taking into consideration the ascertained toleration of the salts by the several crops."

The physical conditions of arid soils are especially favorable to extensive root growth and to the capillary rise of water, thus enabling plants to grow with a limited amount of water in the soil. The alkali salts present also assist in collecting and conserving moisture. The abundant supply of readily available plant food present, even in the coarse-grained soils, contributes to the vigorous growth of plants.

A study of the native vegetation has shown "what plants indicate, in California, [alkali] land which under present economic conditions is irreclaimable; while it has been as definitely shown that the presence of certain other plants, known to be tolerant of alkali, indicates that certain crops can be grown successfully."

An investigation of cranberry soils (*New Jersey Stas. Rpt. 1898, pp. 122-124*).—Mechanical and chemical analyses of soils from bogs producing healthy and unhealthy (rotting) berries and chemical analyses of healthy berries and healthy and unhealthy vines are reported. These show that soils on which the berries did not rot contained more silt and clay and iron and aluminum and less nitrogen than those producing diseased berries. The vines which produced rotten fruit contained much less potash and phosphoric acid than those which bore sound fruit.

"The same is true in a less degree in the case of soda, lime, and sulphates. The differences in nitrogen which were in the soils did not appear in the vines. The analysis of good berries themselves indicates that the same mineral constituents, and especially the potash and phosphoric acid, and to a smaller degree the lime, are essential to the healthy growth of this fruit.

"In view of these results, together with the good effects from the addition of clay to many bogs, which contributes to both their mechanical and chemical improvement, the Station suggests that in the case of rotten bogs, a liberal application of phosphoric acid and potash might, in part at least, correct the deficiencies which are shown to exist in the soils and vines from bogs producing rotten fruit, the phosphoric acid to be drawn preferably from natural guanos, or from basic slag phosphate, and the potash to be in the form of a sulphate."

On the sterilization of water by means of ozone, T. WEYL (*Chem. Ztg., 23 (1899), No. 78, p. 816*).

The influence of forests on moisture, BUHLER, EBERMAYER, HOPPE, and MÜTTRICH (*Ztschr. Forst u. Jagdw., 31 (1899), No. 9, pp. 547-551*).—An outline report is given of suggested investigations on the influence of forests on precipitation, water conservation, etc.

Influence of forests on subterranean waters (*Agr. Gaz. New South Wales, 10 (1899), No. 12, pp. 1264-1267*).—A brief review mainly of articles by Brouillard, Henry, and Ototzky (E. S. R., 9, p. 1041) on this subject.

Analysis of cocao soils from Venezuela and Trinidad, P. CARMODY (*Abs. in British Food Jour., 1 (1899), No. 7, pp. 210-211*).—Gives results of analyses by the Government analyst of Trinidad.

FERTILIZERS.

Fertilizers, S. W. JOHNSON, E. H. JENKINS, ET AL. (*Connecticut State Sta. Rpt. 1898, pp. 1-101*).—This includes statistics of fertilizer sales in Connecticut in 1898, an abstract of State laws relating to fertilizers, a list of manufacturers complying with the laws, notes on the sampling and collecting of fertilizers, explanations concerning the analysis and valuation of fertilizers, a review of the fertilizer market for the year ended October 31, 1898, suggestions regarding the purchase of fertilizers, and tabulated analyses and valuations of 569 samples of fertilizing materials classified as follows: (1) Raw materials containing nitrogen as the chief valuable ingredient—nitrate of soda, sulphate of ammonia, dried blood, cotton-seed meal, castor pomace, and rape-seed meal; (2) raw materials containing phosphoric acid as the chief valuable ingredient—rock phosphate, dissolved boneblack, and acid phosphate; (3) raw materials containing potash as the chief valuable ingredient—high-grade sulphate of potash, double sulphate of potash and magnesia, muriate of potash, kainit, carbonate of potash, silicate of potash, phosphate of potash, and tobacco stems; (4) raw materials containing nitrogen and phosphoric acid—bone manures, tankage, and fish; (5) mixed fertilizers—bone and potash, nitrogenous superphosphates and guanos, special manures, and home mixtures; (6) miscellaneous fertilizers and manures—cotton-hull ashes, corncob ashes, wood ashes, limekiln ashes, lime, marl, plaster, bat guano, street sweepings, ground weed seed, jadoo fiber, and rotted peat.

The samples of nitrate of soda examined were of good quality, the price per pound of the nitrogen which they furnished varying from 12.7 to 14.7, averaging 13.5 cts.—1 ct. less than last year. In 2 samples of sulphate of ammonia analyzed the price per pound of nitrogen was 14.3 and 15.5 cts.; in 2 samples of dried blood, 11.4 and 13.1 cts. In 34 samples of cotton-seed meal the percentage of nitrogen ranged from 7.04 to 7.97, averaging 7.44, the price per pound of nitrogen from 10.2 to 12.4, averaging 11.5 cts., "the cheapest form of quickly available organic nitrogen in our market." Five samples of castor pomace were examined, the percentage of nitrogen ranging from 4.60 to 5.70; the price per pound of nitrogen from 14.7 to 18.3 cts.

The cost of available phosphoric acid in dissolved boneblack ranged from 6 to 6.9 cts. per pound, the average in 7 samples being 6.5 cts. In 6 samples of dissolved rock phosphate, the cost of available phosphoric acid varied from 3.1 to 7.4 cts. with an average of 3.9 cts.

The cost of potash in 5 samples of high grade sulphate varied from 4.6 to 5.1 cts. per pound, averaging 4.8. In 8 samples of low grade double sulphate of potash and magnesia, the cost ranged from 4.9 to 6.8 cts., with an average of 5.8 cts. per pound. In 11 samples of muriate of potash, the cost per pound of potash ranged from 3.8 to 4.5 cts., averaging 4.2 cts., "the cheapest source of water-soluble potash in the market." The cost of potash in kainit varied from 5.1 to 6.3 cts. per pound.

"Of the 119 analyses of nitrogenous superphosphates examined, 23 were below the manufacturer's minimum guarantee, in respect of 1 ingredient, and 3 in respect of 2 ingredients. The number which failed to come up to the guarantee was relatively about the same as in the previous year. . . . The average cost of the nitrogenous superphosphates was $29.22; the average valuation was $19.30. . . .

"Of the 111 samples [of special manures] analyzed, 33 did not fulfill the manufacturer's minimum guarantee in respect of 1 ingredient, and 6 were each deficient in respect of 2 ingredients. . . . Thirteen were deficient in nitrogen, 22 in potash, and 10 in phosphoric acid. In 8 of the 10 cases, however, the available phosphoric acid was as guaranteed, the deficiency being only in the insoluble part of the phosphoric acid. The average cost per ton of the [special manures] examined was $33.11; the valuation, $21.72."

In 47 samples of cotton hull ashes the highest percentage of potash found was 31.09, the lowest 15.08, the average 23.3. "Allowing 4½, 4, and 2 cts. per pound respectively for water-soluble, citrate-soluble, and insoluble phosphoric acid, the water-soluble potash has cost from 4.8 to 10.7 cts. per pound, or 7.1 cts. per pound on the average."

Fertilizers (*New Jersey Stas. Rpt. 1898, pp. 15–87*).—This is a reprint of Bulletin 132 of the station (E. S. R., 10, p. 1031), with the addition of statistics of the fertilizer trade in New Jersey, the market prices of fertilizers, the text of the fertilizer law, and lists of inspectors and of manufacturers whose goods were inspected during 1898.

From the data furnished by 75 out of the 90 firms selling fertilizers in the State it is estimated that the total consumption of fertilizers in New Jersey in 1897 was 56,172 tons (about 200 tons less than in 1896), valued at $1,551,073. "The complete manures represented 73 per cent of the total number of tons sold in 1897, and 78 per cent of the total value of all sales."

"There was a decrease in the sales of complete fertilizers, due partly to the fact that the season was a poor one, and partly to the constantly increasing tendency among the farmers toward the purchase of raw materials. The sale of these 'incomplete' fertilizers has increased in a striking manner during 1897; all of the raw materials, with the exception of the superphosphates, show large gains over 1896, varying from 8 per cent in the case of kainit to 230 per cent in the case of sulphate of potash."

Methods to determine the availability of organic nitrogen in fertilizers, J. P. STREET (*New Jersey Stas. Rpt. 1898, pp. 88–100*).—This article reports the individual results of tests of the pepsin method on complete fertilizers, a summary of which was given in the Annual Report of the station for 1896 (E. S. R., 9, p. 637), as well as further investigations by means of vegetation experiments and the permanganate and pepsin methods.

For the vegetation experiments boxes 18 in. square and 12 in. deep were used. The artificial soil used (about 75 lbs. in each box) was sifted coal ashes with 3 per cent of muck containing 0.86 per cent of nitrogen. To each box was added 30 gm. potassium phosphate, 1.5 gm. sodium chlorid, 2 gm. magnesium sulphate, and 96 gm. calcium carbonate. Amounts of nitrate of soda, dried blood, tankage, cotton-seed meal, hoof meal, raw bone, and raw leather furnishing 5 gm. of nitrogen were used. The crop grown was oats, 50 plants in each box.

The amount of nitrogen in the above-ground crop indicated a wide variation in the availability of the nitrogen of the different materials, "ranging from 4.9 per cent in the case of leather to 33.1 per cent where nitrate of soda was used."

"The fact that only 33.1 per cent of the nitrogen applied as nitrate of soda was utilized by the plants shows that a large amount still remained in the soil. The small amount which the roots would contain would not affect these figures materially. It would seem, therefore, that in planning the experiment an excessive amount of nitrogen was used, and the percentage availabilities found for that reason can not be regarded as conclusive. They do show, however, wide differences in the availability of the different forms of organic nitrogen. Hoof meal and dried blood stand highest, with 27.5 and 27.4 per cent available, while tankage and cotton-seed meal are considerably less, with 23.1 and 20.6 per cent, respectively. Raw leather, 4.9 per cent, is the lowest, showing this form to be comparatively inert, while raw bone gives an availability of but 10.3 per cent. This figure, however, does not show that the nitrogen of ground bone is necessarily inferior to that of other organic nitrogenous materials, as ground bone is most successfully used on grass, clover, and fruits, which are not annual crops, and which extract plant food from the soil more or less actively during prolonged periods."

The materials used in the above experiments, as well as dry ground fish, wool waste, bone sawings, and steamed bone, were tested by the permanganate and pepsin-hydrochloric acid methods.

The permanganate methods used were as follows:

"*Method in acid solution.*—Weigh 1 gm. of material into a 500 cc. flask, add a little paraffin and 100 cc. of permanganate solution (consisting of 16 gm. of potassium permanganate and 100 cc. of concentrated c. p. sulphuric acid to the liter). Connect with distilling apparatus and heat at a low temperature just below boiling for 1 hour. Then add 50 cc. of saturated sodium hydrate solution, distill for 30 minutes, and tritrate as usual.

"*Method in alkaline solution.*—Weigh 1 gm. of material into a 500 cc. flask, add a little paraffin and 100 cc. of permanganate solution (consisting of 16 gm. of potassium permanganate and 300 cc. of saturated sodium hydrate solution to the liter). Connect as before and heat below boiling point for 1 hour. Then increase the temperature and distill for 30 minutes as above. . . .

"After making a number of tests it became evident that the method, as suggested, was a difficult one to control. The directions provided that during the digestion the solutions should be heated just below boiling. This was found to be almost an impossibility, and it was very difficult to maintain uniform conditions in 2 different sets of tests. The results showed the 3 forms of bone to be the most available, while the others follow in this order: tankage, wool waste, fish, hoof meal, blood, cotton-seed meal, and leather. These results were far from satisfactory, as it was known that, with the exception of the leather, the order of their availability should be almost reversed."

The following method was tested with more satisfactory results on a great variety of nitrogenous materials:

"Weigh an amount of the material equivalent to 0.075 gm. of nitrogen into a 500 cc. Erlenmeyer flask, add 100 cc. of neutral 1.6 per cent permanganate of potash solution, and digest on a steam bath for 30 minutes, shaking occasionally to moisten any particles of the material adhering to the sides of the flask. Filter and wash 3 or 4 times, using from 125 to 150 cc. of water. Determine the total nitrogen in the undigested residue by the ordinary Kjeldahl method. . . .

"The results secured by this treatment are remarkably striking, the difference in the effect of the permanganate solution of the various ammoniates being very noticeable. The percentage availability varies from 95.9 per cent in horn to 25.5 per cent in raw leather. The other materials range in availability between these limits in the approximate order one would expect vegetation cultures to show. The ground horn sample is possibly somewhat above the average of that material, it having been carefully prepared in this laboratory and being nearly 5 years old. . . .

"Of the 3 classes of bone examined, the steamed bone shows the highest degree of availability. This is doubtless due to the fact that the process of steaming had in a large measure removed the fatty matter. The hard button bone ranks next in availability, while the raw bone meal, in which much fat was present, ranks lowest of the 3 forms of bone examined. The availability of the dissolved bone is slightly below that of raw bone, seeming to indicate that the treatment with sulphuric acid had little effect on the nitrogenous matter in the bone. The 2 samples of garbage are low in availability, as would be expected, as are also the various samples of leather.

"These results show that striking and reasonable differences in availability may be secured by this method, and while definite conclusions can not be drawn from them in the absence of actual tests with the plant itself, they do give indications of much promise in the effort to secure a rapid and accurate method for laboratory practice."

On the availability to grass of nitrogen in form of nitrate of soda, cotton-seed meal, and fine hard bone, E. H. JENKINS and W. E. BRITTON (*Connecticut State Sta. Rpt. 1898, pp. 289–296*).—This is a continuation of previous investigations (E. S. R., 10, p. 232). The pots used were like those employed in earlier experiments, and the methods pursued were in general the same. The soil experimented with contained about (slightly less than) 0.1 per cent of nitrogen. Precipitated calcium carbonate was added at the rate of 9.5 gm. per pot (containing 29 lbs. of soil), or the equivalent of 1 ton of slaked lime per acre; muriate of potash 1.8 gm. per pot or 500 lbs. per acre; and precipitated phosphate 1.2 gm per acre, or the equivalent of about 1,000 lbs. of acid phosphate per acre. The 3 nitrogenous substances were added at rates furnishing equal amounts of nitrogen as follows: Nitrate of soda (15.89 per cent of nitrogen) 461 and 331 lbs. per acre, cotton-seed meal (7.4 per cent of nitrogen) 991 and 496 lbs., and pure raw knuckle bone (3.67 per cent of nitrogen) 1,990 and 995 lbs. The amount of moisture in the soil was maintained at from 11.6 to 15.5 per cent, or 50 to 70 per cent of that which it could hold if saturated.

Three small sets cut from a tuft of redtop were planted in each pot.

"The pots were filled and planted February 14 to February 17, and stood till June 10 in the greenhouse, having a temperature by day of about 60° F. and by night about 50° F. During the summer the pots were placed in the summer vegetation house, and brought into the greenhouse again in October.

"The grass was cut whenever it reached a length of 3 or 4 in., thus imitating the practice of grazing or lawn-mowing, and all the clippings were carefully saved.

"In early summer nitrogen was determined in the 3 clippings which had been already made, and again in the fall it was determined in the next 3 clippings. The first 3 clippings were made on March 31, April 27, and June 7. The 3 later cuttings were made July 11, August 29, and October 1. After the last cutting the growth was very slow, and the grass in every pot looked yellow, as if starving. A seventh cutting was, however, made on January 7, 1899."

The data, which are tabulated, show that when nitrate of soda was applied at the rate of 461 lbs. per acre (73 lbs. of nitrogen) 90 per cent of the nitrogen was recovered in the crop, which was increased 31.7 per cent; when an equal amount of nitrogen in form of cotton-seed meal was used 50 per cent of the nitrogen was recovered, the crop being increased 6.3 per cent; while with the same amount of nitrogen in fine hard raw bone only 5 per cent was recovered and the crop was not increased.

"When half the quantities of nitrogen named above were used, the following percentages of the fertilizer nitrogen were recovered in the crops: From nitrate of soda, 77 per cent; from cotton-seed meal, 66 per cent; from bone, none."

With the smaller quantities of nitrogen the yield was increased in case of nitrate of soda 5.6 per cent, of cotton-seed meal 2.1 per cent. In case of the bone there was a decline in yield.

"It appears that the effect of the nitrogenous fertilizers on the amount of crop nitrogen was shown chiefly in the first 3 clippings [these being much richer in nitrogen than the later clippings]. In the second half of the year the yield of nitrogen was not very much larger on those pots which had received fertilizer nitrogen than on those which had received none.

"But, on the other hand, the gross yield of air-dry crop was considerably greater in the latter part of the year than in the early part immediately following the application of the nitrogenous matters."

Phosphates, 1899, E. WILLIS (*Tradesman, 42 (1899), No. 9 (21 annual), pp. 137, 138*).—A summary of the trade in phosphates, especially in the United States. The total production in the United States in 1899 is stated to be: Florida phosphate 858,975 tons, South Corolina phosphate 419,763 tons, Tennessee phosphate 500,000 tons, North Carolina phosphate 13,000 tons; total, 1,791,738 tons.

Complete analysis of phosphate from the island of Fernando Noronha, Brazil, H. LASNE (*L'Engrais, 14 (1899), No. 50, p. 1189*).—The sample analyzed contained 86.5 per cent of calcium phosphate, 5.6 per cent of calcium carbonate, and 2 per cent of iron oxid and alumina.

The black phosphates of the Pyrenees (*L'Engrais, 14 (1899), No. 51, pp. 1212, 1213*).—See E. S. R., 10, p. 833.

Phosphate deposits in Japan, K. TSUNETO (*Chem. Ztg., 23 (1899), Nos. 77, p. 800; 79, pp. 825–827*).

Effect of nitrogenous fertilizers on the percentage of protein in grasses and legumes, C. S. PHELPS (*Proc. Soc. Prom. Agr. Sci., 1898, pp. 130–136*).—This is a brief summary of experiments which have been carried on at the Connecticut Storrs Station for several years and have been reported upon from time to time in the publications of that station (E. S. R., 9, p. 746). In these experiments the use of nitrogenous fertilizers resulted in an increase of both yield and nitrogen content of grass, corn, rye, oats, and wheat.

On the sulphur in plants, S. BOGDANOV (*Zhur. Russ. Fiz. Khim. Obshch., 31 (1899), No. 4, p. 471; abs. in Bul. Soc. Chim. Paris, 3. ser., 22 (1899), No. 23, p. 965*).—From the beneficial effects of fertilizers containing sulphates the author concludes that sulphur is of more importance in plant growth than is usually assumed. The methods of Liebig, Carius, Stoeckhardt, and Schraeder for determining sulphur were compared on cereals, leguminous plants, and beets. Liebig's method is preferred for accuracy and simplicity. Nearly 12 times as much sulphur was found in the products examined as appears in their ash. In view of this fact the author thinks that the question of exhaustion of sulphuric acid in the soil is of practical importance.

FIELD CROPS.

The culture of buckwheat, S. BOGDANOV (*Selsk. Khoz. i Lyesov., 193* (*1899*), *Aug., pp. 227-271*).—A study is being made of the buckwheat plant in Russia for the purpose of determining a more rational system of its culture. The results of the first season's work are recorded and a review given of the literature of the subject.

The buckwheat selected for study was *Fagopyrum esculentum aptera.* It was grown in the Botanical Gardens of Kiev University on a clayey soil. Plants were taken for analysis every 2 weeks. The following table shows the average weight of the plants at different stages of growth and some of the more important mineral constituents:

Weight per plant and analysis of buckwheat (*roots and vines*) *at different stages of growth.*

Date sample was taken.	Average weight of plant.		Analysis of air-dried plant.					
	Fresh.	Air dry.	Moisture.	Nitrogen.	Phosphoric acid.	Potassium oxid.	Calcium oxid.	Sulphur.
	Grams.	*Grams.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
May 31	0.212	0.020	7.163	2.484	2.589	5.314	1.298	0.441
June 16	.781	.076	9.702	2.389	2.099	5.905	1.514	.307
July 2	2.771	.353	8.517	1.800	1.703	4 815	.979	....
July 16	3.108	.622	8.191	1.376	1.318	2 872	.779	.238
July 29	2.158	.658	8 087	1.098	.946	2.734	1.763	.273
August 6	2.491	1.035	8.105	1.006	1.204	2.627	2.192	.388

It will be seen from the table that the greatest increase in dry matter takes place during the later growth of the plant, and that there is quite a regular decrease in the percentages of nitrogen, phosphoric acid, and potash as the plant develops. This decrease is not observable in the case of lime and sulphur.

Comparing the demand on the soil made by buckwheat with that of oats, the author finds that in order to obtain even a low yield of oats the soil must contain much more nitrogen and somewhat larger quantities of other nutrient materials than are required for a crop of buckwheat.

The 2 latest cuttings of buckwheat were examined for chlorin. The sample analyzed July 29 contained 0.04 per cent and the sample analyzed August 6, 0.07 per cent. The author thinks it doubtful whether chlorin plays the important part in the growth of buckwheat ascribed to it by both scientists and practical growers.

If the sulphur contained in the buckwheat August 6 is taken as 1, the nitrogen will be represented by 2.6, phosphoric acid by 3.1, potash by 6.8, and lime by 5.6. These figures are taken as furnishing valuable hints as to the fertilizers required by buckwheat, i. e., the relative unimportance of nitrogen and the very great need of potash and lime. The proportionately large percentages of nitrogen, phosphoric acid, and potash found in the early vegetation periods of buckwheat plants, would seem to show the desirablity of applying fertilizers in the early stages of growth and in such a position that the young rootlets may readily find them.

The method of root development of buckwheat was especially studied. The root of the buckwheat plant first penetrates into the soil vertically, forming no laterals. Later on laterals are formed, beginning at the upper portion of the main root. At a certain period of development the main root ceases development but the laterals, especially the upper ones, still continue to multiply and increase in length until the plant matures.—P. FIREMAN.

The manuring of cotton, G. P. FOADEN (*Jour. Khedivial Agr. Soc. and School Agr., 1 (1899), No. 6, pp. 207–214*).—This is a brief discussion of the manuring of cotton in Egypt, in which is incorporated the results of some experiments made by the Khedivial Agricultural Society, with barnyard manure, poudrette, and guano. The principal conclusions drawn are that the cotton crop in Egypt is benefited by the judicious use of fertilizers. Fresh barnyard manure is not a desirable fertilizer for this crop, but poudrette of the best quality applied at the rate of 1⅕ tons per acre gave excellent returns. Poudrette and other manures applied in excessive quantities did not give profitable returns. Guano proved to be a valuable fertilizer. Judicious manuring hastened the ripening of the crop, consequently a greater proportion of the total yield was obtained at the first picking and the crop was therefore more valuable.

Hop cultivation in Bohemia, D. G. FAIRCHILD (*U. S. Dept. Agr., Division of Botany Circ. 19, pp. 6*).—A popular account of hop culture and management in Saaz and Auscha, "the two most noted hop growing districts of Bohemia." Male plants are not permitted to grow in the hop yards in these districts, and hops containing over 0.2 per cent of seed are rated as second class. In Saaz a house has been erected for the benefit of buyers by the Hop Growers' Association of the city, which certifies to the quality of the hops grown in the different parts of the district. The Auscha red hop is the principal variety grown in both districts. This hop brought 58 cts. per pound in American markets when native hops were selling for 19.5 cts. per pound. Cuttings of this hop have been ordered by the Department for importation in 1900.

Fertilizer experiments with barnyard manure on sugar beets (*Deut. Landw. Presse, 26 (1899), No. 93, pp. 1047, 1048*).—The barnyard manure employed was obtained (1) from deep stalls in which 20 steers had been fed and (2) from ordinary stalls, the steers receiving in both cases the same rations, and the manure being in part preserved under cover and in part exposed to the elements. The fertilizers were applied at the rate of 800 kg. of barnyard manure and 800 kg. of nitrate of soda per hectare. To avoid the loss of ammonia, a weak solution of sulphuric acid was sprayed over a part of the stable manure at the time of its removal to the field. Analyses of the fertilizers preserved under different conditions are given, and the total yields and percentages of sugar in beets grown on plats differently fertilized tabulated.

Considering the results with the manures unsprayed with sulphuric acid, the largest total yield of both roots and leaves was obtained from the field fertilized with manure from the deep stalls. The sugar in the beets was 0.5 per cent less than in the beets grown on the plats fertilized with the manure from the ordinary stalls, but the total yield per hectare, 7,674 kg., was 694 kg. more than was obtained on the plat fertilized with barnyard manure preserved under shelter and 998 kg. more than the yield with barnyard manure which had been exposed to the elements. When the manures were sprayed with a dilute solution of sulphuric acid, the yields of both roots and tops were considerably increased, except in the case of the unsheltered manure, where they were slightly lessened. The largest total yield of sugar beets per hectare was obtained from the plat which had been fertilized with the sheltered, acid-sprayed manure from the ordinary stalls. This yield was at the rate of 49,872 kg. of roots, 20,800 kg. of tops, and 8,329 kg. of sugar per hectare, the purity of the sugar in the juice averaging 90.2 per cent.

Spraying was not found a satisfactory method of incorporating sulphuric acid with barnyard manure, and it is suggested that a better method would be to soak a mixture of sand and peat in the dilute acid and mix this with the manure as it is removed from the stalls.

Cultivation of cigar-leaf tobacco in Florida, M. L. FLOYD (*U. S. Dept. Agr., Rpt. 62, pp. 31, pls. 8, figs. 6*).—The introduction into Florida within recent years of Cuban tobacco for cigar-leaf fillers and Sumatra for wrappers has greatly stimulated the tobacco industry in this State and led to improved methods of culture and handling. The bulletin in hand summarizes the progress along these lines thus far made and gives the present status of the industry within the State. The author discusses in detail the requirements of the cigar-leaf trade; the field culture, harvesting, curing, fermenting, grading, sorting, and baling of Florida-grown Cuban tobacco; the selection and preparation of the seed bed for Sumatra tobacco; field work required in its production, and the relative value of new and old land for its growth; and gives plans and specifications for the building of tobacco barns and for the cost of opening and operating a 500-acre tobacco plantation.

Light gray sandy loam soil with a clay subsoil is recommended for Cuban tobacco and new low hummock land for Sumatra. At the present time Cuban tobacco is set 14 in. distant in the row, well fertilized, and 16 leaves at least left to each stalk after topping. Cultivation stops as soon as the tobacco is topped. In the culture of Sumatra tobacco a very rich soil and quick growth are required. Each stalk is left with 24 to 30 leaves after topping. If the soil is very rich topping is omitted entirely. The plants are set from 12 to 14 in. in the drill. New lands are especially desirable for this tobacco, though good results have been obtained on well-fertilized old soils.

One of the most important innovations in the growing of tobacco in Florida is the introduction of shade sheds, made either of slats or cheese cloth. The slat sheds are covered with 2-inch slats placed 2 in. apart. The cheese-cloth sheds consist of a framework covered with cheese cloth. In 1898 one tobacco firm in Gadsden County planted 200 acres of tobacco under shade. A yield of 800 lbs. per acre, with 50 per cent wrapper, is reported. About 600 acres were planted under shade in this county in 1899.

The cost of raising tobacco on large plantations is estimated at 18½ cts. per pound. Small farmers who raise tobacco in connection with other crops report the cost as being between 10 and 12 cts. per pound. The finished product from the small farms is generally inferior to the well-cured product of the larger plantations. Well cured and baled Florida fillers sell for as high as 45 cts. per pound, while wrappers bring from 50 cts. to $2 per pound, according to style and quality.

Curing and fermentation of cigar-leaf tobacco, O. LOEW (*U. S. Dept. Agr., Rpt. 59, pp. 34*).—The author discusses the chemical and physiological changes which occur in the different processes of curing, sweating, after fermentation or aging, and petuning of tobacco, and the bacterial fermentation theory of Suchsland; and presents the results of his own investigations on the curing and fermentation of tobacco, involving bacteriological, chemical, and chemico-physiological studies. A short bibliography of recent foreign literature bearing on the subject is appended.

While it is generally admitted that the so-called fermentation of tobacco is a process of oxidation, authorities differ regarding the causes. The views of Nessler, Schloesing, and Suchsland are discussed. The latter holds (E. S. R., 3, p. 354) that the oxidation and development of heat are due to the action of certain bacteria. The author believes this theory to be erroneous, since he finds no bacteria in the cells or on the surface of fermenting Florida tobacco leaves, although some spores may occur. While in the process known as petuning an immense number of bacteria may be deposited on the leaf, they are not essential to fermentation. There is under the most favorable condition insufficient moisture in fermenting tobacco to bring nourishment to the bacteria on the surface from the interior of the leaf. Should water exist in excess, bacterial action may set in, but to the detriment of the structure of the leaf. Finally, as the tobacco approaches the end of the fermentation process, it becomes less fit to support bacterial life, as was shown by experiment. The theories of Nessler and of Schloesing as to the cause of the oxidizing action are also opposed.

As a final agent capable of causing the energetic oxidizing action which takes place in the tobacco cells after death the author suggests that of oxidizing enzyms. The nature and occurrence of enzyms and their action toward certain reagents are discussed in considerable detail, and the views of the author and others given on the physiological functions of oxidizing enzyms.

The investigations of the author lead him to conclude that—

> "There exist, evidently, 2 kinds of oxidizing enzyms in the Florida tobacco leaf. The first kind oxidizes guaiaconic acid to guaiac blue without the aid of peroxid of hydrogen, but the second kind oxidizes it only when this substance is present. Both kinds of oxidizing enzyms, which may be distinguished as tobacco oxidase and tobacco peroxidase, occur in the fresh as well as in the recently fermented Florida tobacco leaf. The former enzym is, however, much more sensitive to heat than the latter, being killed at from 65 to 66 C. (149 to 151° F.), while the latter is killed only at from 87 to 88° C. (188.6 to 190.4° F.)."

Dark Florida tobacco 2 years old yielded no reaction for tobacco oxidase and only a moderate one for tobacco peroxidase, "while a sample of light-colored tobacco 4 years old from the same source yielded not the slightest reaction either for the oxidase or the peroxidase." Both the oxidase and the peroxidase occur in young tobacco plants, and in the fresh tobacco leaf they were found in the ribs and veins as well as the parenchyma.

> "The bundle sheath and sieve tissue give the most intense reaction on the oxidase, while the reaction on the peroxidase sets in quickly and with about uniform intensity in all the cellular tissues. The growing point and youngest leaves contain an especially large quantity of the oxidase. A section through the stalk shows oxidase only in the sieve tissue and bast parenchyma, while peroxidase also is contained in the pith. Both enzyms are found in the root, the former more in the central and the latter in the peripheral parts and also in the flower. The stigma of the pistil and the stigmatic fluid also show strong reaction upon oxidase."

Directions are given for obtaining colorless solution of tobacco peroxidase and for the complete extraction of oxidases from fermented and cured tobacco. The oxidase is thought to be the more powerful, but it more quickly succumbs to alcoholic influence or a rising temperature. The oxidase was found by experiment to bear more resemblance to laccase than to tyrosinase.

In order to prove that the oxidizing enzyms contained in tobacco leaf can decompose nicotin, 50 gm. of unfermented Connecticut tobacco, which showed a strong reaction for peroxidase but none for oxidase, was thoroughly moistened with water, and allowed to stand for 2 days in a 250 cc. solution of 50 per cent alcohol. The liquid obtained by pressing was mixed with 1½ times its volume of absolute alcohol and a brown-colored precipitate, containing a large proportion of peroxidase obtained. The precipitate was dissolved in 20 cc. of water and 0.5 gm. of nicotin tartrate added. This mixture was digested for 2 days at from 50 to 60° C. in a 500 cc. flask, to which a small U tube containing a dilute solution of chemically pure sulphuric acid was attached. An examination of the acid at the end of this period revealed the presence of small amounts of ammonia, and still larger amounts of nonvolatilized ammonia were found in the mixture itself.

The following are among the author's conclusions:

"The principal changes that take place during the curing and fermenting of tobacco are due to the action of soluble ferments or enzyms.

"Several kinds of enzyms act in the curing process, (1) an amylolytic, (2) a proteolytic, and (3) 2 oxidizing enzyms, while in the fermenting process the main changes are due to oxidizing enzyms alone, and consist in the oxidation of nicotin and other compounds.

"The presence of the amylolytic and the proteolytic enzyms is inferred from the saccharification of the starch and the decomposition of proteids, but the enzyms themselves have not yet been isolated from the tobacco leaf.

"In green tobacco 2 oxidizing enzyms may exist—an oxidase and a peroxidase. The former succumbs much more readily to noxious influences than the latter and in all probability exerts a more powerful action.

"The development of color and aroma is due principally to the action of the oxidizing enzyms."

Temperature changes in fermenting piles of cigar-leaf tobacco, M. WHITNEY and T. H. MEANS (*U. S. Dept. Agr., Rpt. 60, pp. 28, charts 7*).—Results are given of some investigations upon the temperature changes in fermenting tobacco in Florida and Connecticut, together with a résumé of Loew's investigations on the cause of tobacco fermentation (see above) and of the method of fermenting tobacco employed in Florida (E. S. R., 10, p. 748).

The data secured in Florida are given in tables and charts and discussed. The results show that in fermenting Florida leaf tobacco a moisture content of 23 or 24 per cent is most advantageous for best results. Twenty per cent is too low for the full activity of the enzyms causing fermentation, while 26 per cent is too high and furnishes conditions favorable to the development of rot or mold. The relative humidity for the fermenting room for Florida leaf tobacco should be maintained at 80 or 90 per cent, while the temperature should range from 70 to 80° F. during active fermentation, and for the so-called cold fermentation from 60 to 70° F. With these conditions maintained, the temperature in the center of the piles should rise from 8 to 10° F. per day until it reaches 130 to 135° F., when the piles should be rebuilt and the operation again started. The rebuilding of the bulk from 6 to 8 times is necessary usually before the operation of active fermentation is completed. The wrapper leaves are bulked in a drier condition and the temperature is not allowed to rise higher than 110 to 120° F.

A trial of the Florida methods of fermentation with Connecticut tobacco showed that the latter did not reach a higher temperature than 100° F. under conditions similar to those in which the Florida leaf had risen to 144° F. An examination of the Connecticut leaf showed the absence of oxidase, though peroxidase was present. The former enzym, however, was found in the growing Connecticut tobacco plant. The course of disappearance of this enzym between the time the tobacco is cut and the period of fermentation is being studied.

Experiments in curing and fermenting tobacco, E. H. JENKINS (*Connecticut State Sta. Rpt. 1898, pp. 297–301*).—These experiments are in continuation of those previously reported (E. S. R., 10, p. 242). A detailed description is given of a new curing barn in which artificial heat may be used. The crop secured in 1898 was light and of rather poor quality. It was hung in the barn and cured in the usual manner, except that in the evening and in unfavorable weather artificial heat from the furnace was employed. The object of using artificial heat was to maintain constantly the best natural conditions for curing tobacco and to protect the tobacco from chilling, from the deposit of water on it, and from alternate dampening and drying. The curing operations in the new barn were entirely successful. The tobacco put in the barn July 29 had come to color August 20. From the results of the experiment the author is confident that "the use of artificial heat in some form will make the curing of tobacco less hazardous and give a better average quality of leaf."

The loss of water in tobacco during the curing process was investigated. Six plants were weighed at harvest time and at different periods thereafter until the tobacco was cured. From the results obtained it is calculated that the 24,160 lbs. of green tobacco put in the barn July 29 had decreased in weight from loss of moisture to 5,332 lbs. on September 23.

The fermentation of tobacco in bulk, E. H. JENKINS (*Connecticut State Sta. Rpt. 1898, pp. 302–307*).—The author gives results of efforts to ferment Connecticut tobacco in bulk by the methods practiced in the South (see p. 729). The usual practice in Connecticut is to ferment in cases. The sorted leaves are tied into "hands" containing 13 to 20 or more leaves, and packed into cases of about 300 lbs. each. These cases are allowed to ferment naturally during one summer and are sold at the end of that period by sample. There is no control ot the operation and its success is in doubt until the operation is completed. Frequently the operation of fermentation is hastened by putting the cases in a room heated to 90, 100 or even 130° F. In this way the tobacco is made ready for market in 6 or 8 weeks from the time it is cased.

In order to test the bulk method of fermentation, a basement room having a steam pipe running through it was fitted up. By means of a steam cock the average temperature in the room during fermentation was maintained at about 82° F. and the relative humidity at about 80 per cent. The first bulk fermented contained 930 lbs. of tobacco—314 lbs. of top leaves and 616 lbs. of bottom leaves. The top leaves were judged to be in a good condition of fermentation, but the seconds were considered too dry. "The temperature of the top of the bulk arose to 100° F. in 9 days, or at the rate of 4° in 24 hours. The temperature of the center rose to 102° F. in the same time, or at the rate of 4½° in 24 hours. The temperature at the bottom in the same time rose to 79° F., or less than 2° per day." At this point the bulk was rebuilt and the temperature of the pile again rose steadily for 5 or 6 days, after which it gradually declined and thermometer readings were discontinued. The product was sold and pronounced to be well sweated by the dealers.

A second bulk consisting of 1,305 lbs. of wrappers was fermented in the same manner. The bulk was rebuilt 3 times. Data for the rise of temperature of the top, center, and bottom of the bulk are given for each of the different periods.

"The [fermented wrapper] leaf was examined by a dealer in leaf tobacco and by a cigar manufacturer, both of whom found it 'well sweated,' not distinguishable from leaf fermented by the usual methods, and having an odor of old tobacco quite different from the leaf which had been fermented at a high temperature in cases.

"These observations indicate that high temperatures, 120-130° F., are not at all necessary for the rapid fermentation of tobacco, and that Connecticut leaf will ferment perfectly well in piles instead of cases, and when the process is complete, will be moist enough to be readily handled and cased down."

Wheat (*Kentucky Sta. Bul. 83, pp. 35-50, pls. 2*).—Variety experiments and fertilizer tests with wheat are reported.

Thirty-three varieties of wheat were grown in 1899. The yields of straw and grain per acre are tabulated for each variety. Field notes on each variety and the meteorology ot the season are given, together with descriptive notes and illustrations of 13 varieties not previously described by the station (E. S. R., 10, p. 842). Kansas Mortgage Lifter gave the largest yield, 14.6 bu. per acre, and the heaviest grain, 66.5 lbs. per bushel, of the varieties grown in 1899, followed by Turkish Red, 13.9 bu.; Fultzo-Mediterranean, 13.2 bu.; Rice wheat, 13.2 bu., and Indiana Swamp, 13 bu. per acre.

The fertilizer experiment at the station gave only negative results, and the results of 2 cooperative experiments were not striking. The experimental land in every case was poor and the net value of the crops on the plats receiving fertilizers in no instance exceeded the value of the crop on the best plats receiving no fertilizers.

Variety tests of wheat, G. C. WATSON and E. H. HESS (*Pennsylvania Sta. Bul. 46, pp. 7*).—Thirty-two varieties were tested in 1898 and 22 in 1899. Average yields of a few varieties for 2, 3, 4, 6, 9, and 10 year periods are also given. The best yields of grain in 1898 were as follows: Dawson Golden Chaff, 41.42 bu.; Gold Coin, 37.97 bu.; Forty-fold, 37.57 bu., and Fulcaster, 37.15 bu. per acre. Wet weather in June caused a weak growth of straw, as a result of which 49.2 per cent of the smooth varieties and 76.5 per cent of the bearded varieties lodged badly. In 1899 the best varieties grown as regards grain yield were: Royal Red Clawson, 26.87 bu.; Forty-fold, 26.8 bu., and Dawson Golden Chaff, 26.43 bu. per acre. Reliable, Fulcaster, and Ontario Wonder, with yields of 31.82, 31.77, and 31 bu. per acre, respectively, have given the best average results for 10 years.

The question as to whether wheat will run out is discussed with the aid of tables. Varieties grown at the station for 10 years show an increase in yield of 0.05 bu. of grain per acre and 1.04 lbs. in weight per bushel for the last 5 years over the preceding 5 years of the test, but a decrease in the yield of straw for the same period of 424 lbs. per acre. In this connection the author notes that, "On the limestone soils of the State where proper cultivation and fertilization are given and due regard had to the selection of the seed, a variety of wheat should not run out. Where the soil, cultivation, manuring, and seed selection are not the best, it will pay a farmer to change his seed occasionally."

Fertilizer tests on winter cereals, L. VAN DEN BERCK (*Belg. Hort. et Agr., 11 (1899), No. 19, pp. 292, 293*).—*Wheat.*—Three plats of 5 acres each of clay soil were employed. The preceding crop had been potatoes fertilized with a light dressing of stable manure. In the test no fertilizers were employed on plat 1. Plat 2 received fertilizers at the rate of 800 kg. of Thomas slag containing 16 per cent of phosphoric acid; plat 3, the same amount of slag and in addition a fractional application of 250 kg. of nitrate of soda per hectare. Plat 1 yielded at the rate of 1,860 kg. of grain and 3,225 kg. of straw per hectare; plat 2, 2,310 kg. of grain and 3,990 kg. of straw; and plat 3, 3,065 kg. of grain and 5,970 kg. of straw. The results are believed to show the value of using nitrogen with phosphoric acid for wheat when the preceding crop has been other than a leguminous one.

Rye.—The experiments with rye were conducted on plats of sandy soil, similar in size to the ones noted above, which had been cropped with potatoes the preceding season. Plat 1, which received no fertilizer, yielded at the rate of 1,720 kg. of grain, and 3,750 kg. of straw per hectare; plat 2, fertilized at the rate of 600 kg. of slag (containing 16 per cent phosphoric acid) and 50 kg. of nitrate of soda, yielded at the rate of 2,220 kg. of grain and 4,100 kg. of straw per hectare; plat 3, fertilized with the same amount of manures as plat 2 in the fall and 150 kg. additional nitrate of soda in the spring, yielded at the rate of 2,640 kg. of grain and 5,060 kg. of straw; plat 4, fertilized the same as plat 3, with the addition of 400 kg. kainit, yielded at the rate of 2,850 kg. of grain and 5,430 kg. of straw. The increased yield due to potash in plat 4 was thought by the author to show the value of using potash on light soils poor in this element.

The wheat crop of 1899, J. B. LAWES (*Gard. Chron., 3. ser., 26 (1899), No. 668, pp. 292, 293*).—The author gives tabulated data showing the yield of wheat at Rothamsted in 1899 on unmanured land and on land fertilized with barnyard manure or commercial fertilizers, and on this basis estimates the quantity which must be imported by the United Kingdom. Wheat grown at Rothamsted successively for 56 years on the same ground yielded in 1899 at the rate of 12 bu. per acre on a plat which has received no fertilizer; at the rate of 42.5 bu. on a plat fertilized with barnyard manure; and at the average rate of 36 bu. per acre on plats receiving commercial fertilizers. Wheat grown on plats in a four-year rotation of roots, barley, clover (or beans), and wheat, in which the whole crop has been removed every year since the beginning of the experiment in 1849, yielded at the rate of 30.25 bu. per acre. Turnips had practically failed on these plats and barley had gradually decreased in yield. These results are interpreted as showing the "remarkable capability of wheat to collect its food from what is, agriculturally speaking, exhausted soil," and as having an important bearing on the problem of future wheat production as related to increasing population.

Utilizing the American corn crop (*Queensland Agr. Jour., 5 (1899), No. 6, pp. 530–532*).—Popular notes on the utilization of corn in the production of oil, spirits, glucose, corn rubber, etc.

Manila hemp (*Sci. Amer., 82 (1900), No 2, p. 24*).—An account of its production in the Philippines and suggestions about machinery needed in its preparation for market.

The sisal hemp, H. J. BOEKEN (*Tropenpflanzen, 4 (1900), No. 1, pp. 6–27, figs. 11*).—Culture and manufacture in Mexico, with descriptions of machinery used.

The manuring of hops, H. H. COUSINS (*Agr. Gaz.* [*London*], *50 (1899), No. 135, pp. 348, 349*).—A summarization is given of a number of experiments with potash salts on hops. The author considers barnyard manure the safest and most satisfactory fertilizer for supplying hops with this element.

Potato experiments, 1898, N. GRAHM (*Tidskr. Landtmän, 20 (1899), No. 14, pp. 242–246*).

Comparison of newly imported potatoes, F. E. H. W. KRICHAUFF (*Jour. Agr. and Ind., South Australia, 3 (1899), No. 5, pp. 449–451*).—Yields and starch content of a number of varieties of potatoes recently imported are given.

Results of fertilizer experiments with potatoes, A. SCHILLING (*Ztschr. Landw. Ver. Hessen, 1899, No. 52, p. 669*).—Data on yield and starch content of potatoes grown on soil fertilized with different amounts and combinations of kainit, superphosphate, chlorid of potassium, and nitrate of soda.

Soy beans (*Kansas Sta. Press Bul. 46, pp. 2; abs. in Bul. North Carolina State Bd. Agr., 20 (1899), No. 11, pp. 26, 27*).—Directions for the culture of soy beans, with an account of the cost of growing and harvesting 60 acres at the station. The total cost was $155.25; total yield, 932 bu.

The Swedish sugar-beet crop of 1898 (*Tidskr. Landtmän, 20 (1899), No. 12, pp. 199–201*).—Area of beets grown, 22,924 hectares; beets delivered to sugar factories, 480,945,500 kg.; average yield per hectare, 20,893 kg. (= 18,644 lbs. per acre); average sugar content, 13.93 per cent.

On the preservation of sugar-beet tops (*Landtmannen, 10 (1899), No. 41, pp. 664–666*).—Sugar-beet tops and beet pulp were buried in pits 3 to 4 meters wide and ¾ to 1 meter deep, in alternate layers, 8 to 12 in. thick; 2 or 3 kg. of common salt were added for every load. When the mass was 3 to 4 ft. high above the ground it was covered with a layer of dirt. The pits were made with flaring wall, and at the bottom a drainpipe was laid to carry off excess of water. The tops and pulp so preserved kept in good condition until the following June. Milch cows ate this silage with the greatest relish, but always ate the beet tops first. An analysis of the ensiled beet tops only was made at Alnarp experiment station laboratory, with results as follows: Water, 83.22 per cent; crude fat, 0.11 per cent; albuminoids, 1.09 per cent; amids, 0.26 per cent; acids (mainly lactic and oxalic), 1.25 per cent; carbohydrates, 5.90 per cent; pure ash, 1.18 per cent; sand (dirt), 6.99 per cent. The silage had no deleterious effect on the quality of the dairy products or on the health of the cows.—F. W. WOLL.

Fertilizer experiments with sugar beets at Alnarp, 1898, H. WINBERG (*Tidskr. Landtmän, 20 (1899), No. 16, pp. 275–277*).

Report on the experiment garden, 1898–99, J. D. KOBUS and J. A. VAN HAASTERT (*Meded. Proefstat. Oost Java, 3. ser., No. 15, pp. 23, dgm. 1*).—Results are given of fertilizer experiments, combined culture and fertilizer experiments, fertilizer experiments with nitrate of soda containing perchlorate, and culture experiments on uplands with sugar cane.

The tillering or stooling proclivities of wheat, J. L. THOMPSON (*Agr. Gaz. New South Wales, 10 (1899), No. 12, pp. 1247, 1248, fig. 1*).—This subject is briefly discussed and an account given of finding 4 stools of wheat containing 112, 120, 120, and 116 straws, respectively, per stool. Thin seeding of cereals to encourage stooling is urged.

Culture experiments with spring wheat, S. RHODIN (*Tidskr. Landtmän, 20 (1899), No. 15, pp. 253–258*).

The treatment and yield of permanent pastures in Switzerland, a report, S. AANESTAD (*Tidsskr.-Norske Landbr., 6 (1899), No. 7, pp. 310–322*).

The irrigation of meadows (*Deut. Landw. Presse, 26 (1899), No. 90, p. 1019*).—A brief discussion of the best time to irrigate grass lands.

HORTICULTURE.

Forcing cucumbers—experiments on the value of deep and shallow benches, O. M. TAYLOR (*Amer. Gard., 20 (1899), No. 259, pp. 830, 831*).—Experiments were made to determine the relative value of growing cucumbers in benches full of soil and in benches containing but little soil, the soil being increased as the plants developed.

Three benches 6 in. deep and 2½ ft. wide, running east and west in an even-span greenhouse, were partitioned and one-half of each filled with a good soil. The other half was filled with the same soil, as required from time to time by the growing plants. On March 15, Improved White Spine, Extra Long White Spine, and Telegraph varieties of cucumbers, which had been started with bottom heat in four-inch pots, were carefully transferred to the benches. The plants were set in 2 rows 2 to 3 ft. apart and 22 in. in the row. Plants in the partially filled benches were filled around with 5 six-inch pots of soil and the soil covered with a thin layer of moss to prevent washing down during watering and spraying. The growing plants were tied to upright stakes, and in the early part of the experiment the laterals were pinched beyond the second pistillate flower. Hand pollination was practiced with the White Spine cucumbers but was omitted with the English variety, Telegraph.

"On April 6, root fibers were showing on the benches with little soil. These were then filled half full and on May 4 the remainder of the soil was added. As early as May 1 it was observed that the growth on all benches containing little soil was not so vigorous nor the foliage so green as on the filled benches, which condition continued until the close of the experiment, on June 22. The benches produced the first marketable fruits and total yield during the experiment as follows:"

Growth of cucumbers in shallow and deep benches.

Variety.	Date of first cut.	Total number cut.
Improved White Spine:		
Shallow bench	May 9	227
Full bench	May 11	212
Extra Long White Spine:		
Shallow bench	May 9	196
Full bench	May 11	210
Telegraph:		
Shallow bench	May 18	113
Full bench	May 23	91

The experiment is thought to indicate that there is "a tendency to earlier maturity and greater yield on shallow benches," and that the blooming period is slightly earlier on the shallow benches. Shallow benches also tend to restrict the growth of the plant. The author suggests that where room is limited for the development of the vines, 9 in. of soil would prove more satisfactory than 6 in.

Report of the assistant in horticulture, A. T. JORDAN (*New Jersey Stas. Rpt. 1898, pp. 127-190, pls. 6*).—The work of the department has been a continuation of that already outlined (E. S. R., 10, p. 433). Experiments with asparagus, blackberries, raspberries, currants, and gooseberries were conducted to study the following problems: The effect of irrigation, the relative effect of fertilizers with and without irrigation, the effect of the addition of nitrate of soda, and the influence of the different treatments upon earliness. The results were as follows:

Asparagus (pp. 130, 131).—Considering all varieties together, irrigation gave in every case the largest first cutting, also the largest totals with a single exception. Among fertilizers the complete fertilizer gave highest yields. Irrigation changed the relative effectiveness of the fertilizers but slightly.

Blackberries (pp. 132, 133).—Irrigation increased the yield at the first picking in 2 cases and the total yield very materially in 3 cases. Irrigation on plats receiving barnyard manure and complete fertilizer gave largest yields. On unirrigated plats, barnyard manure gave largest yields, with ground bone and muriate of potash second. Nitrate of soda gave the smallest yield in almost every case. In point of earliness, ground bone and potash on unirrigated plats, and complete fertilizer on irrigated plats, gave best results.

Raspberries (pp. 133-135).—The results differed but little from those obtained with blackberries. Irrigation did not materially affect the relative effectiveness of fertilizers.

Currants and gooseberries (pp. 135, 136).—In these cases the number of varieties was fewer, and the tests with complete fertilizer were omitted. Irrigation increased the yield in every case with the currants, but with the gooseberries in only one case. On both irrigated and unirrigated plats barnyard manure gave the highest yields.

Strawberries (pp. 136–145).—The lines of experiment reported the preceding year were continued. In tests of fertilizers with and without irrigation, nitrate of soda increased earliness on unirrigated, but decreased it on irrigated plats. The complete fertilizer gave the largest total yield in both cases. The author concludes that "it is inadvisable to apply nitrate of soda in connection with a fertilizer already rich in nitrogen. With low grade materials its addition is beneficial to the crop." Comparative experiments with hill culture and the matted row system were continued, with results confirmatory of those already published.

Variety tests were continued, combined with which were tests of adaptability to hill culture. In only 2 cases did the yield of the hills exceed that of the matted rows.

Variety tests of vegetables have been carried on for 3 seasons, as already outlined (E. S. R., 9, p. 649).

Peas (pp. 146–159).—A comparative test was made of 81 varieties with respect to earliness of starting, earliness of maturing, length of season, percentage of shelled peas in total weight, number of peas per pod and length of same, height of vine, and the yield and weight of same. The smooth sorts are considered inferior to the wrinkled varieties in all respects except earliness. It is believed that all the numerous varieties of dwarf smooth peas are developed from the old Philadelphia Extra Early and Dan O'Rourke, from which they differ but little. Varieties differ much in the yield of shelled peas obtained from a given quantity of pods, an extreme variation of 12 per cent being found. Among the early dwarf wrinkled varieties, Exonian and Station were earliest.

Among the late half-dwarf and tall smooth varieties, Pride of the Market gave nearly twice as large a yield as any other. New Giant Pod Marrow was one of the earliest and most productive of the Marrowfats. Melting Sugar is recommended.

Among the medium and late half-dwarf and tall wrinkled varieties the following are spoken of favorably: Advancer, Admiral, Bliss Abundance, Bliss Everbearing, Yorkshire Hero, Stratagem, Stratagem Improved, Queen, and Héroine. Besides a good yield, the last named gave the largest percentage edible of any variety grown.

Drawings were made of the typical pods of the various sorts, showing the general outline, a cross section, and the split pea. Eighteen of these are published.

A comparative test was made of plants trained to woven-wire trellis and untrained plants, with the result that generally the untrained plants gave a larger percentage of the total yield in first pickings than those trained, but in total yield and weight per plant the trained sorts, with two exceptions, gave much better results than those untrained.

A test of the extent of variation within the same variety was made with duplicates from the same lot of seed and with seed of the same variety from different seedsmen. The test was made on a gravelly loam ridge, sloping mostly to the south, but partly to the north. In the tests of duplicate lots as large differences occurred in all cases on adjacent lots as between plats on opposite sides of the field. The weights per plant varied in the same ratio as did the yields. The extent of variation among lots from different seedsmen was much greater.

A test was made to determine the approximate quantity of seed that should be used per 100 ft. of drill to secure the best results. Five thicknesses of planting were made with 8, 10, 12, 14, and 16 plants per foot of drill, or 1 qt. of seed to 356, 285, 238, 204, and 178 ft. of drill, respectively. In every case there was a greater yield per plant, a larger plant growth, and earlier maturity in the thinnest plantings; but for the space occupied, the thickest plantings gave the largest yield. No difference in the size of pods between the different lots was observable.

Beans (pp. 159–176).—Tests of 72 varieties of beans are reported, and the pods of 14 typical sorts are figured. Tests of extent of variation within the limit of the variety were carried out exactly as with peas. With duplicate lots, similar results were obtained, but with seed from different seedsmen the variation was much greater even than in the case of peas.

In tests made to determine the quantity of seed, sowings were made with 2, 4, 6, 8, and 10 plants per foot of drill, or 1 qt. of seed to 810, 405, 270, 203, and 162 ft. of drill, respectively. "One quart of seed in 162 ft. of drill gave the largest yield. There was a tendency in the thicker plantings toward smaller pods. The vines were more spindling, and general development was reduced in the thickest plantings."

A test was carried on to show that under field conditions a crop of beans and peas followed by sweet corn could be grown during the summer and at the same time the general fertility of the soil be increased by the use of crimson clover. The test was successful with the exception that a not very good catch of clover could be obtained. In connection with the double cropping a test of fertilizers was carried on. Five plats, one twenty-fifth of an acre each, were treated as follows: Plat 1, check; plat 2, barnyard manure, 800 lbs.; plat 3, muriate of potash, 7 lbs., and acid phosphate, 14 lbs.; plat 4, same as plat 3, plus nitrate of soda, 6 lbs.; plat 5, same as plat 3, plus nitrate of soda, 2 lbs., and dried blood, 6 lbs. The results of the test with each vegetable are tabulated. In almost every case barnyard manure gave the largest yields. Plats 4 and 5 of sweet corn gave a poor yield.

In the course of this test ash analyses were made of the different vegetables from each of the plats to determine whether there was any difference in the composition of the vegetables. The results are tabulated, but no deductions are drawn. Food and ash analyses are also tabulated for typical varieties of peas and beans, of pea pods and of the shelled peas, of sweet corn (corn and cob), and of the husks separately.

Bush Lima beans (pp. 177–180).—The author believes that this vegetable has not yet received as much attention as its merits deserve. Tests of 5 varieties are reported.

A test was made to determine the number of plants to be grown in a given space for best results. Earliest maturity, largest yield, and largest plant growth were obtained from plants standing 18 in. apart. For the space occupied, however, the thickest planting (plants 3 in. apart) gave the largest yield.

A comparative test was made of surface and subirrigation, natural conditions, and mulching. The natural conditions gave the best results throughout. A fertilizer test was made with Lima beans, using the same general plan as already described for the peas, beans, and corn. Earliness, yield, and plant development were in the following order: Plats 5, 3, 2, 1. "The quickly available nitrate in plat 4 hastened maturity, while the nitrate in plat 5, as a starter, followed with the more slowly available blood, has given the largest yield."

Tomatoes (pp. 180–190).—Tests of 29 varieties are reported. Perfection, Giant Seedling, Favorite, and Beauty gave the largest total yields.

Nitrate of soda, alone and in connection with potash and acid phosphate, was tested with respect to its effect on earliness. Nitrate of soda applied every 15 days gave the largest yield throughout, and nitrate of soda with minerals produced the earliest and best shaped fruit.

A test was made to determine the best time to sow seed to get the best results considering earliness and total yields. The results were not decidedly in favor of any one date. "Unless one has sufficient space to give plants of the earlier sowings plenty of room for development, the most satisfactory results will be obtained by sowing seed from the 10th to the 15th of March."

A comparison of irrigation, natural conditions, and heavy mulching with salt hay resulted as follows:

> "Irrigation and mulching each increased the amount of rotten fruit, irrigation relatively having the greater increase. The appearance of the fruit from the mulched row was far superior to that of the other rows. The color was also a little lighter. Irrigation increased the [total] yield somewhat, while a very decided increase occurred with mulching. The value of the mulch undoubtedly depends upon the earliness of application and the amount of soil moisture in the ground at the time. Within limits, the earlier the mulch is applied, the better the results obtained."

The relative productiveness of the first plants appearing in a lot of seed and those last or slowest in germinating was compared. The seeds that germinated most quickly gave the largest early and total yields of marketable fruits, amounting in the total to 30 oz. per plant. Not only was the yield of marketable fruit low in the last germinating, but the proportion of culls was considerably greater, there being 28 per cent more culls than in the first germinating lot. It is profitable to select the first plants germinating, discarding all others.

The possibilities of growing 2 horticultural crops, as peas and tomatoes, the same year, and the benefits of lime were tried. Peas were planted early in the spring. Before the crop was gathered, tomato plants were set between the rows. The peavines were left upon the ground after harvesting as a mulch for the tomatoes. The two crops were very successfully grown. In the lime test nitrate of soda in all cases gave the earliest yield, but lime caused a greater growth of vine.

Experiments with shading, B. D. HALSTED (*New Jersey Stas. Rpt. 1898, pp. 337, 338*).—A continuation of work already reported (E. S. R., 10, p. 435). For climatic reasons the growth of spinach was very unsatisfactory, but was evidently favored by shade. Tests were made with lettuce, but no satisfactory results were obtained. Shaded areas of wax and Lima beans yielded much less than fully exposed plants. There was no blight upon either of the areas of wax beans, but the Lima beans were blighted, there being 6 times as much blight on the shaded plants as on those not shaded.

On the plat of Lima beans a test was also made with purslane. This weed was allowed to grow for a short time and was then pulled and weighed. The exposed area produced 18.56 lbs., while the shaded area produced only 2.15 lbs., and this mostly about the edges of the shaded soil where sunlight was most abundant.

Pineapple fertilizers, P. H. ROLFS (*Florida Sta. Bul. 50, pp. 104, pls. 8, figs. 8*).—In this bulletin the general plan, details, and results are given of extensive fertilizer experiments with different forms of potash, nitrogen, and phosphoric acid used alone and in various combinations on pineapples. The effect of the different fertilizers on the general development of the plants, on the leaf area, abundance and earliness of fruit blooms, and on the frost-resisting properties has been studied, and the results are discussed at length and illustrated by diagrams and photographs.

The experiments were carried out on the east coast of Florida on rather poor spruce-pine lands, which had never been fertilized. Fifty-one plats were used, 27 of which were about one-twentieth acre in size and were manured with complete fertilizers. The remaining plats were about $\frac{1}{100}$ acre in size and received incomplete fertilizers. The fertilizer used as a normal formula was made up of 3 per cent nitrogen, 7 per cent potash, and 5 per cent available phosphoric acid. Plats receiving this fertilizer were manured February 7 and 8, 1898, at the rate of 1½ tons per acre, June 27 and 28 with 2½ tons per acre, November 4–12 with 2 tons per acre, April 1–4, 1899, with 1½ tons per acre, and July 6 with 1½ tons per acre. After the first application, a number of the plats were further subdivided into from 3 to 6 sections in order to study the effects of increasing or decreasing the amounts of the different fertilizer elements in the normal formula. The source and composition of the manures used, number of plants in each plat, and the combinations and amounts of fertilizers used on each plat and plat subdivision at the different dates of application are given in detail.

A summarization of the accumulated data shows results as follows: The leaf area development of the plants, found by multiplying the width of the leaf at the base by its length in inches and dividing by 2, was greatest on plats fertilized with a blood, bone, and tankage mixture, an average of 34.6 sq. in. per leaf. Of the potash manures the largest average leaf area was found on plants grown on the plats which had received potassium-magnesium carbonate, 30.8 sq. in. per leaf. The leaf area of plants fertilized with bone meal averaged 32.34 sq. in., while the average of the plants receiving acid phosphate was only 25.2 sq. in. On plats which received nitrogen and phosphoric acid but no potash, the average leaf area was 28 sq. in. per leaf, and on plats which received nitrogen and potash but no phosphoric acid 26.8 sq. in. per leaf.

The frost-resisting properties of the plants were greatest in sections receiving the normal formula, or the normal formula with a double amount of phosphoric acid or potash. Increasing the nitrogen in the normal formula, or increasing the normal formula 1½ or 2 fold caused the plants to be more sensitive to frost. Considering the value of the different forms of nitrogen in the complete fertilizers, the data show that plants fertilized with blood and bone were more frost resistant than plants fertilized with cotton-seed meal, sulphate of ammonia, or nitrate of soda in the order named. With regard to potash, plants fertilized with potassium-magnesium carbonate were more frost resistant than plants which received kainit, muriate of potash, or sulphate of potash (both low and high grade forms). "Plats fertilized with acid phosphate were no more nor less frost-resistant than those fertilized with bone meal." Plants receiving incomplete fertilizers were less frost-resistant than the average of those which received complete fertilizers. "An excess of potash or phosphoric acid does not seem to increase the frost-resistant qualities over the normal formula." No relation was found to exist between the leaf development of the plants on the different plats and their frost-resisting properties, as some of the best developed plants were among those most injured by the February freeze. Nitrate of soda and sulphate of potash both had a tendency to hasten the blooming period and the number of blooms, and at the same time to increase the sensitiveness of the plants to frost. A table of fruit picked on some of the plats during the month of June, 1899, is given.

On the basis of these experiments the author suggests a plan for fertilizing pineapples in Florida as follows: If the plants are set in July or August, a handful of fertilizer composed of 3 parts cotton-seed meal and 1 part fine ground unleached tobacco dust should be immediately dropped into the bud. This serves the double purpose of preventing the plants from filling with sand and of furnishing them with a certain amount of food. In October or early November, an application of 680 lbs. of blood and bone and 500 lbs. of potassium-magnesium carbonate per acre should be applied. This application should be repeated the following February or as soon after as danger of frost is past. If the plants are in good condition, this amount may be increased to 1,000 lbs. of blood and bone and 750 lbs. of potassium-magnesium carbonate. Shortly before the beginning of the rainy season a third application, consisting of 1,000 to 2,000 lbs. of blood and bone, and from 750 to 1,500 lbs. of potassium-magnesium carbonate, should be given. This should be followed by another application in October or early November. Should the plants fail to thrive at any time during the season a light application of nitrate of soda is recommended.

The insects and diseases most affecting pineapples are noted and suggestions offered as to their control.

Tea culture: The experiment in South Carolina, C. U. SHEPARD (*U. S. Dept. Agr., Rpt. No. 61, pp. 27, pls. 9, figs. 1*).—A report on the growing of several varieties of tea at Pinehurst estate in South Carolina, on different soils, with an account of the cost of production, machinery used, and methods of picking and handling employed in the manufacture of tea, and a discussion of the possibility of tea growing in this country.

Experiments begun on a small scale in 1889 have been continued until at the present time [illegible]0 acres are under cultivation. The labor problem has been solved by the establishment of schools where negro children are taught the ordinary school branches free of charge, and also to pick tea leaves under the direction of a competent teacher. The actual cost of pruning, manuring, cultivating, leaf picking, and factory work for a crop of 300 lbs. of Assam-hybrid tea obtained from the garden in 1898 was 28.5 cts. per pound. It is thought this cost might be reduced to 16 cts. per pound on large plantations.

Some of the more important data on the cost, yield, etc., of tea-growing at Pinehurst for a number of years on different soils are shown in the following table:

Production, cost, etc., of tea growing at Pinehurst.

Location.	Variety of plant	Age of garden.	Extent of garden.	Distance between plants.	Production of green leaf in 1898.	Production of dry tea in 1898.	Production of dry tea per plant in 1898.	Cost of commercial manure per lb. of dry tea.[a]
		Years.	*Acres.*	*Feet.*	*Ounces.*	*Pounds.*	*Ounces.*	*Cents.*
Drained pond	Assam hybrid	9	0.83	6	21,701⅛	323	5.57	2.3
Clayey hillside	do	9	1.50	6	12,631⅛	188	1.88	5.3
Sandy level	do	9	.66	6	6,959½	103½	2.57	5.0
Cleared swamp	do	9	2.66	6	22,069	328	1.78	3.9
Do	do	8	1.87	6	16,110	240	1.92	4.1
Mostly clayey hill	Chinese	6	2.00	4	20,653	308	1.00	5.0
Drained pond	Darjeeling	4	1.90	4	17,854	266	1.00	4.0

[a] The fertilizer used contained 5 per cent available phosphoric acid, 5 per cent potash, and 5 per cent ammonia (chiefly from dried fish and blood).

The tea plant requires a moist climate and soil and an abundance of complete fertilizers. The best results at Pinehurst have been obtained on moist, well-drained, level land. The use of cowpeas is advised for planting between the rows.

Tea growing should not be undertaken where the temperature frequently goes lower than 25° F. The freeze of February, 1899, made it necessary to vigorously prune back all the tea plants at the Pinehurst plantation to within a few inches of the ground. The plants were protected in part by a covering of snow. Plants which had been most exposed to the weather and had thus best ripened their wood were least injured. The freeze diminished the early picking of tea slightly, but the total yield in 1899 exceeded that of the previous season by about 23 per cent and no diminution in the strength of the finished tea was observed.

Considerable green tea of excellent quality has been produced. Hand labor was necessary in its preparation and this made its production costly. A well-equipped two-story factory has been built for the manufacture of black tea, with a capacity of 50 lbs. of dry tea per day. A description is given of the factory and equipment. The results thus far obtained seem to make it probable that "the cultivation of tea can be made profitable in the warmer portions of the United States in two ways . . . (1) By establishing a plantation . . . with a capital sufficient to carry the work to a point where the product can be offered on equal terms with teas holding an established place in the markets of the United States, and (2) to grow tea for home use in the farm garden."

The cheaper grades of tea can not be profitably grown without the protection of an import duty of 10 to 20 cts. per pound. The better grades can be grown at a financial profit in the Southern States without fear of serious competition from oriental producers, wherever climate and labor conditions are satisfactory.

Detailed directions for the culture of tea, picking the leaves, handling the crop, etc., are given. It is thought that a few tea plants might be profitably grown in nearly all Southern home gardens and thus furnish a supply of tea for family use. The experiments are being continued and extended.

Experiments in chestnut grafting, W. E. Britton (*Connecticut State Sta. Rpt. 1898, pp. 276–288, pls. 2, figs. 1*).—The results of grafting chestnuts at the station at different dates and by different methods and the experience of 3 prominent Connecticut horticulturists in chestnut grafting are detailed, and notes given on the technique of chestnut grafting, characteristics of American, European, and Japanese chestnut scions, and in making grafting wax. A short bibliography of chestnut literature is appended.

The experiments at the station involved the use of more than 200 scions of the better varieties of European and Japanese chestnuts. These were grafted on American stocks (*Castanea dentata*) at different dates in April, May, and June. Cleft grafting was generally practiced and 2 scions usually placed in each stock. Whip grafting was employed where the stocks were small. Grafting wax was freely used, care being taken to cover each portion of the wound air tight, and the tops of scions when cut. Raffia was used as tying material.

Accidents befell a number of the grafts. The dates of setting the remaining grafts, average growth, and number of grafts living October 1 are shown in the following table:

Results of chestnut grafting at the Connecticut Station in 1898.

Time of setting scions.	Number of scions set.	Alive October 1.		Average growth.
		Number of scions alive.	Percentage of number set.	
				Inches.
Between April 20 and May 1	29	3	10	18
Between May 1 and May 15	56	26	46	28
Between May 15 and June 1	41	13	32	23
Between June 1 and June 15	47	22	47	22
After June 15	12	2	17	8

The author states that the scions first set were mostly of the Japanese variety, and that those set the last half of May were set in the tops of large trees, while the others were mostly placed in thrifty young sprouts or seedlings. Most of the stocks when exposed to the sun were severely injured by sun scald, whole branches in some cases dying back to the fork or body of the tree. To avoid this the author thinks it advisable to leave enough branches to afford partial shade to the grafts for some weeks after the scions have been set. Whip or tongue grafts made the smoothest unions.

The experience of A. J. Coe at Meriden, Conn., and others is reported. During the season of 1895–96, some 18 acres of sprout land at Meriden was cleft grafted with Japanese scions. The author visited this orchard in 1897 and, while no accurate census was taken, he considers that about 30 or 35 per cent of the grafts set lived and grew. J. H. Hale reports that out of 600 grafts set in native sprouts 1 to 2 in. in diameter in the spring of 1897, when the leaves were just starting on the stocks, only about 25 per cent of them lived and grew through the season. Both European and Japanese scions were used, and cleft, saddle, and tongue grafting employed. Cleft grafting proved the least successful. Seventy-five per cent of the Japanese variety Reliance lived. N. S. Platt finds the after-care of chestnuts during the first season almost as important as the grafting, and recommends the prompt removal of robber shoots and additional branches. Bud grafting at the surface of the ground and root grafting have been failures with Mr. Platt. With stock ¼ in. in diameter 3 ft. from the ground, Mr. Platt finds it desirable to cleft graft; but with stocks ¾ in. in diameter at this height the bark graft is preferred.

Experiments with lawn grasses, B. D. HALSTED (*New Jersey Stas. Rpt. 1898, pp. 327, 328*).—In 1896, 9 plats were seeded with grass and they have been closely cut with a lawn mower during each season since that time. The author shows in a table the species of grass in each plat and its relative stand for 3 years. Based on the results for 3 years, the author believes that a satisfactory lawn mixture would consist of Rhode Island bent grass, Kentucky blue grass, redtop, and Italian rye grass.

Sketch of the present status of horticulture, gardening, and viticulture in Russia, and the government measures for their development (*St. Petersburg: Min. Agr. and Imp. Domains, 1899, pp. 110; rev. in Selsk. Khoz. i Lyesov., 194 (1899), July, p. 179*).—Prepared for the Russian National Exposition of Horticulture held at St. Petersburg in the fall of 1899.

Composition and application of manures, A. H. BENSON (*Queensland Agr. Jour., 5 (1899), No. 6, pp. 565–574*).—The use of fertilizers with formulas for their application in the growing of citrus fruits, bananas, pineapples, strawberries, and certain other garden and farm crops.

The Chevrier kidney bean, H. DAUTHENAY (*Rev. Hort., 71 (1899), No. 15, pp. 363–365*).—Notes on the care and management of these beans to maintain their color and a brief account of the beneficial use of nitrate of soda in their culture.

Methods of winter preservation of endive and other chicory plants, A. OGER (*Rev. Hort., 71 (1899), No. 24, pp. 569–572, figs. 3*).

Culture and manufacture of ginger (*Rev. Cult. Coloniales, 6 (1900), No. 44, pp. 8–13*).

Instructional fruit stations, E. LUCKHURST (*Jour. Roy. Hort. Soc. [London], 23 (1899), pt. 2, pp. 151–154*).—The ends, aims, and practical uses of these stations are discussed. Experimental areas are limited to half-acre plats.

Fruit culture and geology, HANS REUSCH (*Norsk Havetidende, 15 (1899), No. 10, pp. 158, 159*).

The peach (*Topeka: Kansas State Hort. Soc., 1899, pp. 159, figs. 18, dgm. 1*).—Compiled account of the planting, care, management, gathering, packing, and shipping of peaches, with special reference to Kansas. Directions are given for combating insect and fungus pests, and a diagram shows the number of peach trees in 1898 in each county of the State.

Roofing over orange orchards (*Fruitman's Guide, 8 (1900), No. 208, p. 13*).—Methods and results in California.

Olives and olive oil, P. D'AYGALLIERS (*L'olivier et l'huile d'olive. Paris: J. B. Bailliere & Sons, 1900, pp. 350, figs. 64*).

The pawpaw (*Agr. Mexicano, 8 (1899), No. 6, pp. 189–192*).—The history of this interesting fruit in the tropics and its uses as food and medicine are given.

Coffee culture in Queensland, H. NEWPORT (*Queensland Agr. Jour., 5 (1899), No. 6, pp. 584–587*).—Directions for selecting seed, preparing the soil, planting, etc., with notes on varieties and seed germination.

On coffee, W. L. A. WARNIER (*Rec. Trav. Chim. Pays-Bas, 18 (1899), p. 351; abs. in Bul. Soc. Chim. Paris, 3. ser., 21 (1899), No. 24, p. 1104*).—The results of a large number of analyses of coffee from different sources.

Peaberries and male coffee plants (*Queensland Agr. Jour., 5 (1899), No. 6, pp. 582, 583*).—Poverty of soil and dry weather are said to be the causes which tend to the multiplication of peaberries on coffee trees, and the amount of peaberry on a coffee tree is no indication whatever of the sex of the tree.

Shade trees for coffee plantations, L. PIERRE (*Rev. Cult. Coloniales, 6 (1900), No. 4, pp. 4–8*).

Cacao culture in Ecuador (*Planting Opinion, 4 (1899), No. 51, pp. 1018–1020*).—The extent of the production of cacao in Ecuador, methods of planting, cultivating, gathering, cost of growing, and uses are considered, and a description given of the tree, flowers, and fruit.

The cultivation of cocoanut trees (*Shamba [Zanzibar], 1899, No. 17, pp. 1, 2*).—A yield of 7,250 nuts obtained from 350 trees at one picking is recorded. The large yield is attributed to the good effects of digging up the soil to a radius of 6 ft. around each tree, leaving a ridge at the circumference to catch and retain the water. The area was enlarged a little at each digging.

Rubber—the plants that produce it and their cultivation (*Bol. Agr. Min. e Ind., Mexico, 8 (1899), No. 12, pp. 3–35*).

Amur grapes (Vitis amurensis), Tairov et al. (*Odessa, 1898, pp. 37; rev. in Selsk. Khoz. i Lyesov., 193 (1899), May, p. 466*).

The culture of grapes on sands, V. Bertensou and P. For (*St. Petersburg: Min. Agr. and Imp. Domains, Dept. Agr., 1899, pp. 44; rev. in Selsk. Khoz. i Lyesov., 193 (1899), May, pp. 467, 468*).

Forced culture of table grapes, E. Zacharewicz (*Prog. Agr. et Vit., 16 (1899), No. 53, pp. 766–768, figs. 5*).—Illustrated descriptions of grape houses used in the culture of early table grapes, with notes on the cost of construction.

Irrigation and the quality of wine, L. Degrully (*Prog. Agr. et Vit. (Éd. L'Est), 20 (1899), No. 51, pp. 697–701, fig. 1*).

Rose cultures, W. E. Britton (*Connecticut State Sta. Rpt. 1898, p. 268*).—An account with detailed data of growing Duchesse de Brabant roses in the greenhouse in compost, and in coal ashes and peat moss to which commercial fertilizers had been added. Plants set in coal ashes and peat moss gave larger but somewhat lighter colored blooms than those grown in compost. No difference was noticeable as regards fragrance and form. Plants in both media bloomed freely all winter.

Half a century's experience in ornamental tree planting, O. B. Hadwin (*Boston: Massachusetts Hort. Soc., 1900, folio*).—A paper read by the author before the Massachusetts Horticultural Society, in which an account is given of the author's farm experience in planting different varieties of ornamental trees in Massachusetts.

Lawn-grass mixtures as purchased in the market, compared with a few of the best, W. J. Beal (*Proc. Soc. Prom. Agr. Sci., 1898, pp. 59–63*).—The author has observed and experimented with different lawn grasses for a period of 20 years or more, and gives his observations on the value of various grasses for lawns. He also gives approximately the relative abundance of different kinds of grass in each of 17 mixtures, together with the retail price. Many of these grasses are said not to be adapted to lawn purposes and, so far as his observations go, none of the mixtures in the market produce as fine and permanent a lawn as a few of the best grasses used separately. An additional objection to lawn mixtures is the price, which is frequently 3 or 4 times what it would be if the different varieties were purchased separately.

The propagation of ferns, W. C. Worsdell (*Gardening, 8 (1900), No. 176, pp. 122, 123*).—Methods best adapted for the propagation of different species are discussed.

FORESTRY.

Practical assistance to tree planters, G. Pinchot (*U. S. Dept. Agr., Division of Forestry Circ. 22, pp. 11, figs. 5*).—In line with the cooperative plan already announced (E. S. R., 10, p. 443), the Division of Forestry of this Department is prepared, so far as its limited appropriation will permit, to render practical and personal assistance to farmers and others by cooperating with them to establish forest plantations, wood lots, shelter belts, and wind-breaks. A section of the Division has been recently organized which will devote its entire time to investigations in tree planting and to the assistance of those who may avail themselves of the cooperative plan outlined in this circular.

Notes are given on tree planting in the past, value of forests to farmers, and sketches of various successful forest plantations. A form of agreement between the owner and this Department is given.

The white pine (Pinus strobus), V. M. SPALDING and B. E. FERNOW (*U. S. Dept. Agr., Division of Forestry Bul. 22, pp. 185, pls. 13, figs. 40*).—This bulletin was prepared a number of years ago, but delay in its publication made it possible to revise and extend the manuscript, bringing it up to date. The object of the monograph is to lay the basis for an intelligent recuperation of the virgin growth of the white pine forests by the application of rational sylviculture in the remnants of our pineries.

The geographical distribution of our white pine is given and commented upon. Roughly traced, this tree frequents the region adjacent to the Great Lakes, the St. Lawrence Valley, and eastward to the Atlantic Ocean, extending south along the Appalachian Mountain chain. At present there are not less than 400,000 square miles in the United States and the Dominion of Canada throughout which it is said the successful cultivation of the white pine is assured. There is also evidence to show that within the extreme limits of distribution this species makes under cultivation a healthy and rapid growth, and there is apparently no species of equal value indigenous to eastern North America; that is, adapted to so wide an area. On account of the habits of the species near its western limit, as well as results obtained from experimental planting, it seems that successful growth can not be depended upon much beyond its limits.

A discussion is given of the white pine lumber industry, and the original stand and present supply compared. The visible supply at the end of 1897 is placed at about 15 per cent of the original stand. The natural history, including botanical description, relationships, and morphological characters, is given at some length. The rate of growth in height, diameter, and volume, as determined by a large number of observations, is given. The authors discuss the conditions of the development of the white pine, as well as its yield as a crop.

The dangers and diseases to which the white pine is subject are described, that portion treating of the parasitic diseases being translated largely from Hartig's "Lehrbuch der Baumkrankheiten." A chapter is added by F. H. Chittenden, Division of Entomology of this Department, on "Insect enemies of the white pine," in which a number of species are figured and described.

Suggestions are offered for forest management, both of the natural reproduction and artificial plantings, and a brief review is given of the white pine in Germany, where it has been planted for more than a century, and a statement is made that it will probably become one of the prominent forest trees of that country.

The wood of the white pine, F. Roth (pp. 73–82).—The author gives the results of extensive studies into the character and physical properties of this wood, treating of its specific weight, shrinkage, strength, durability, and uses.

An appendix, giving tables of measurements made in the field by A. Cary and A. K. Mlodziansky, completes the bulletin.

Observations on the denudation of vegetation—a suggested remedy for California, M. MANSON (*Sierra Club Bul., 2 (1899), No. 6, pp. 295–311, pls. 4*).—This is a discussion of the injuries due to the denudation of vegetation, based more particularly on observations in the Caucasus and in the Rocky Mountains and the Sierra Nevada.

"The writer advocates that all forest reservations and public lands upon mountain slopes, within the borders of California, be granted by act of Congress to the University of California in trust; that the object of this trust be to protect, maintain, develop, and extend the water supply of these areas forever. For this purpose, that the regents be empowered to lease, under proper control, the timber cutting and pasturage privileges of these areas, and to use this fund: (1) To protect the catchment areas; (2) to maintain a college of practical forestry; (3) to construct reservoirs at such points as may be necessary to the industries of the State, and dispose of the water for the benefit of the trust; (4) to acquire mountain lands to be added to the catchment areas; and (5) to do all such things as may maintain wise systems of forest and water conservation and use."

Forestry in Bosnia and Herzegovina (*Oesterr. Forst u. Jagdw. Ztg., 17 (1899), No. 39, p. 306*).—Gives some statistics on the extent and production of the forests in the above-mentioned countries.

The organization of experimental forestry work in Russia, V. KLYUCHNIKOV (*Selsk. Khoz. i Lyesov., 194 (1899), Aug., pp. 299–302*).—A criticism of certain proposed measures.

On forestry experiment stations, C. G. G. HOLMERZ (*K. Landt. Akad. Handl. Tidskr., 33 (1899), No. 2, pp. 99–106*).

The forest domain of Belgium (*Bul. Soc. Cent. Forst. Belg., 6 (1899), No. 7, pp. 470–494*).—Contains an abstract of the discussion relative to the budget for the administration of forests, etc.

Notes concerning a few trees in the arboretum at the Michigan Agricultural College, W. J. BEAL (*Proc. Soc. Prom. Agr. Sci., 1898, pp. 87–89*).—The author began planting a small arboretum in 1875, and has investigated more than 150 species of trees and shrubs. Notes have been given from time to time on the growth and behavior of these different plants, and in the present paper a tabulated statement is given of the age, height and diameter of a few of the more promising species. Among those mentioned the locust has proved one of the most profitable trees for growth, followed closely by the chestnut, and also by the white ash, white pine, white oak, shaggy-bark hickory, basswood, and sugar maple, and, for poor sandy lands, Norway pine.

Some timber trees of Queensland, J. W. FAWCETT (*Queensland Agr. Jour., 5 (1899), Nos. 5, pp. 499–502; 6, pp. 591–594*).—Notes are given on *Eucalyptus platyphylla*, *E. tesselaris*, *E. microcorys*, *E. maculata*, *E. botryoides*, *E. resinifera*, and *Tristania suaveolens*. The different species are described and their distribution and uses given.

The pinetum at Wellesley (*Gardening, 7 (1899), No. 162, p. 274*).—Notes are given on the pinetum which was laid out in 1865. A list of more than 100 species and varieties of evergreen trees that have proved hardy in New England is appended, most of the species being conifers.

The cork tree (Quercus suber), N. PIKE (*Sci. Amer. Sup., 47 (1899), No. 1222, pp. 19593, 19594*).—Notes are given on the history, cultivation, and uses of the cork oak.

Notes on the Douglas fir, N. I. CRAHAY (*Jour. Soc. Roy. Agr. Belg., 1899, pp. 138, 153–161*).—Notes on *Pseudotsuga douglasii*.

Height growth in plantations, J. SIMPSON (*Gard. Chron.*, *3. ser.*, *26* (*1899*), *No. 662*, *pp. 187*, *188*).—Discussion of this subject as applied to forestry.

Sheep grazing in Arizona, E. S. GOSNEY (*Forester*, *5* (*1899*), *No. 10*, *pp. 230–232*).—The author defends the claim of the sheepmen that grazing does not seriously injure forests or interfere with irrigation works by causing them to fill with silt, etc.

SEEDS—WEEDS.

Germination tests with onion seeds, E. H. JENKINS (*Connecticut State Sta. Rpt. 1898*, *pp. 313–316*).—A number of experiments have been made with onion seeds to test their vitality as affected by age, crop, and variety. Comparisons were made between the vitality of Connecticut and California grown seeds, from which it appears that the latter possessed a higher percentage of germinative ability than Connecticut-grown seed. The average vitality of Connecticut-grown seeds of the crops from 1894–1898 was tested with the result that the 1898 seed was found to possess an unusually low vitality, the reason for which is unexplained. The germinative capacity of different varieties of onion seed was tested, Yellow Globe, Red Globe, White Globe, White Portugal, and Wethersfield Red being compared. All the varieties possessed essentially the same germinative ability except the White Portugal, which was about 6 per cent below the average of the germination of the other varieties. The tests of the Connecticut-grown seed are given in tabular form.

Crimson clover seed, A. J. PIETERS (*U. S. Dept. Agr.*, *Division of Botany Cir. 18*, *pp. 4*, *fig. 1*).—The increased use of crimson clover as a standard crop has led to inquiries regarding its seed. The seed is described, and in general it is stated that crimson clover seed is less liable to contain weed seed than that of the other clovers. In a number of tests made at the laboratory, however, the seeds of 50 weeds have been found more or less frequently. The most serious adulteration is that of the Egyptian clover (*Trifolium alexandrinum*). The differences between the 2 kinds of seeds are pointed out so that one may be able to recognize admixtures of the less desirable species. Notes are given on the germination of clover seed and the amount of seed required per acre. The seed laboratory also offers to test samples sent for that purpose.

On the presence of hydrocyanic acid in the seeds of Vicia, F. F. BRUIJNING and J. VAN HAARST (*Extr. from Rec. Trav. Chim. Pays-Bas*, *18* (*1899*), *No. 6*, *pp. 168–171*).—The authors have made a study of the seeds of a number of species of Vicia to determine the presence of hydrocyanic acid by the method suggested by Dragendorff. Among the species examined were various varieties of *Vicia sativa*, *V. canadensis*, *V. hirsuta*, *V. angustifolia*, *V. narbonensis*, *V. cracca*, *V. biennis*, *V. disperma*, *V. pannonica*, and *V. cassubica*. Among these the *V. angustifolia* yielded the maximum amount of hydrocyanic acid.

The conclusions of the authors are that most species and varieties of the genus Vicia contain amygdalin or analogous bodies, and that the seeds of certain species possess a considerable quantity of hydrocyanic acid, under certain conditions the amount being sufficient to injure animals. To this fact may be attributed the injurious effect of feeding some species after the seeds have matured.

Some chemical changes in the germination of the seeds of Vicia faba, I. SHULOV (*Izv. Moscow Selsk. Khoz. Inst., 5 (1899), pt. 2, pp. 192-202*).—Seedlings 10 days old were investigated. Of the results obtained by the author the following are the most important: Asparagin is rather uniformly distributed in the various organs, while the other amido compounds show a much higher concentration in the cotyledons than in the stalks. The results obtained by T. Lokot with regard to peas are quoted at length. In the latter plant scarcely any difference was observed in the concentration of asparagin in different parts of the plant, while the concentration of the other amido compounds varied greatly.—P. FIREMAN.

Experiments with weeds, B. D. HALSTED (*New Jersey Stas. Rpt. 1898, pp. 332-334*).—In 1897 the author mixed and sowed broadcast the seeds of 30 species of weeds, the object being to note the different degrees of ability to maintain themselves against one another. Only about two-thirds of the different species of seed germinated. By midsummer 15 species were well represented. The more or less conspicuous were sunflower, thorn apple, ragweed, ketmia (*Hibiscus trionum*), pigweed, lady's thumb, velvet leaf, chickweed, catchfly, mallow, purslane, wild carrot, shepherd's purse, and Mexican tea (*Chenopodium ambrosioides*). By the end of the season a number of these had disappeared. The following year the sunflower failed to appear and its place was taken by *Mollugo verticillata*, and *Chenopodium album* had become more abundant than *C. ambrosioides*. During the season covered by the report, 28 species have been observed on the plat in numbers ranging from several hundred specimens down to only one or two. Among the troublesome weeds noted, mention is made of crab grass, but this is kept in check to a considerable degree by a smut fungus (*Ustilago rabenhorstiana*), affected plants rarely if ever producing seed.

Noxious weeds of Wisconsin, E. S. GOFF (*Wisconsin Sta. Bul. 76, pp. 53, figs. 39*).—The author gives the text of the amended Wisconsin weed law, in order that farmers throughout the State may have it in a convenient shape for reference. In order to assist as far as possible in destroying the weeds proscribed by law and also other noxious weeds, descriptions are given, and the best methods of eradication suggested for the following weeds: Canada thistle, burdock, white or ox-eye daisy, snapdragon or toadflax, cocklebur or clotbur, sow thistle, sour dock, wild mustard, wild parsnip, Russian thistle, quack grass, wild carrot, chicory, bindweed or morning-glory, horse nettle, buffalo bur, prickly lettuce, and long-leaved plantain.

Report of Stockholm Seed Control Station, 1897–98, O. STJERNQUIST (*Tidn. Stockh. Läns Hushållnings-sällsk., 1899, May, pp. 99–112; June, pp. 130–135; July, pp. 149–156, figs. 6*).—Illustrations are given of a number of new forms of apparatus constructed by the author for seed examination.

Report of the seed testing at the Modena Experiment Station during the year 1898, F. TODARO (*Staz. Sper. Agr. Ital., 32 (1899), No. 3, pp. 257–273*).—Detailed reports are given of the results of tests of some 590 lots of seeds of all kinds, together with special investigations for dodder in clover and alfalfa seed.

Tests of the vitality of vegetable seeds, E. H. JENKINS (*Connecticut State Sta. Rpt. 1898, pp. 310–313*).—Since November, 1897, 333 samples of seeds have been examined as to their vitality. This has been done in the interests of seed growers and seed dealers in the State. The methods of testing were those adopted by the Association of American Agricultural Colleges and Experiment Stations (E. S. R., 9, p. 143). The results of the tests are tabulated, in which the age of the seed as reported, number of samples, and maximum, minimum, and average of germinations are given.

On the absorption of nutrient solutions by wheat and their influence on germination, VINCENT (*Ann. Sci. Agron., 1898, II, No. 2, pp. 272–302*).

The American Cuscuta, E. SCHRIBAUX (*Jour. Agr. Prat., 1899, II, No. 38, pp. 418, 419, pl. 1*).—The author figures and describes *Cuscuta gronovii*. On account of the fact that this species is said to be parasitic upon a number of plants, the author thinks that there is danger from its introduction into fields of forage plants.

On the destruction of Cuscuta by fire, JAURAND (*Jour. Agr. Prat., 1899, II, No. 38, pp. 423, 424*).—The author recommends the covering of affected regions in alfalfa fields with straw or other litter and burning in the early autumn. In this way he claims to be able to rid fields of this parasite without serious injury to the crop.

Destruction of Cuscuta by copper sulphate, A. BRANDIN (*Jour. Agr. Prat., 1899, II, No. 36, pp. 335, 336*).

Nut grass (*Jour. Agr. and Ind., South Australia, 3 (1899), No. 5, pp. 428–430, pl. 1*).—Illustrated notes are given of *Cyperus rotundus*, which is said to have been introduced into New South Wales and Queensland with importations of dahlia roots. Directions are given for the eradication of this pest. The one most advised is the repeated cutting and removing of the plants.

DISEASES OF PLANTS.

Report of the botanist, B. D. HALSTED (*New Jersey Stas. Rpt. 1898, pp. 291–370, figs. 21*).—As in previous years, the principal lines of experimentation in the field have been with truck crops. Spraying experiments have also been continued, in which Bordeaux mixture, ammoniacal copper carbonate, soda Bordeaux mixture, and creolin were tested. Greenhouse investigations have been continued upon a number of plants, prominent among them being roses and violets. Notes are given on the pear blight, which is being studied in an orchard that has been placed at the disposal of the station for a period of 5 years. Studies on weeds and weed seeds have been continued (see p. 749), and numerous additions to the herbarium are reported.

Experiments with turnips (pp. 292–299).—In continuation of the former experiments (E. S. R., 10, p. 443) the study of club root was pursued. During the season covered by the report the ninth and tenth crops on the same land were grown, and the soil had become thoroughly infested with *Plasmodiophora brassicæ*. Gas lime, carbonate of lime, sulphur, and corrosive sublimate were tested. On both the first and second crops sulphur and corrosive sublimate were without any especial effect, while the limed plats were almost without trace of club root. Leaf spot and heart rot were noticeable, but no difference in susceptibility as to variety was noticed.

Experiments with potatoes (pp. 299–309).—Experiments on the repression of potato scab have been repeated for 5 years (E. S. R., 10, p. 444), in which a number of substances have been tested, both as soil treatments and when applied to the tuber. In 1898 sulphur, potassium sulphid, creolin, and corrosive sublimate were compared. From the yield of the different plats the lowest percentage of scab was obtained where sulphur was applied. Lime tended to increase the liability to injury, while corrosive sublimate applications are said to have been without apparent benefit. In another series of experiments potassium sulphid, potassium sulphate, ammonium sulphate, and creolin were added to the fungicides tested in previous years, but the wet season interfered to such a degree that fully 40 per cent of the tubers rotted in the ground. Where corrosive sublimate had been used only 3 out of 63 plants were lacking at harvest. In this experiment, as previously, sulphur gave the greatest freedom from scab, followed by potassium sulphid, the other substances seeming to have been without effect.

An experiment is reported on the value of different parts of a tuber for seed, in which the stem, middle, and bud ends were compared. No material difference was noticed in yield that could be attributed to the different pieces.

Experiments with beans (pp. 309–313).—Experiments with beans have been continued, the ninth and tenth crops being reported upon at this time. Neither the pod spot fungus nor bacteriosis was abundant during the year. Spraying experiments were conducted, from which the yields obtained were to the advantage of Bordeaux mixture, followed by soda Bordeaux mixture. Creolin and ammoniacal copper carbonate were without effect, the yield from the plats sprayed with these substances being less than that obtained from the check. In another series of experiments ammoniacal copper carbonate as a fungicide gave results next in order to Bordeaux mixture. On one plat of new land which had received a dressing of soil from old bean land, a yield equal to the best obtained where fungicides were used, is recorded.

Experiments with sweet corn (pp. 313, 314).—Five varieties of sweet corn were planted in various plats. One, First of-All, was found to be very susceptible to the bacterial disease due to *Pseudomonas stewarti*, as well as to corn smut. At harvest it was found that cross fertilization had taken place between the different varieties to a considerable extent.

Experiments with peas (pp. 314–316).—Soil treatments with sulphur, corrosive sublimate, carbonate of lime, and copper sulphate were tested for the prevention of stem blight. With the exception of sulphur, all the fungicides tended to repress the disease. On the second crop of peas, mildew (*Erysiphe martii*) was quite abundant but did not materially injure the crop. Vines sprayed with Bordeaux mixture had less mildew than the others, but the stem blight was not lessened to any extent.

Experiments with tomatoes (pp. 316, 317).—Where tomato vines were sprayed with Bordeaux mixture, the blight (*Cladosporium fulvum*) was reduced and the yield of fruit increased. Soda-Bordeaux mixture and creolin were less efficient Tomato plants grown upon new lands suffered more from blight than those upon soil which had previously grown tomatoes. Comparisons are also given upon the relative yield, date of ripening, etc., of a number of varieties.

Miscellaneous experiments with vegetables (pp. 318–334).—Notes are given on experiments with Lima beans, onions, spinach, eggplant, lettuce, cucumbers, beets, and celery. In Lima beans there was little disease, and where Bordeaux mixture and soda-Bordeaux mixture were employed no spotted pods were seen. Inoculation experiments with onion smut (*Urocystis cepulæ*) were tried, in which contaminated soil was introduced into rows without effect. Fungicides and shading were tested with spinach. No blight appeared on any plats during the season. Shaded plants were found to be more vigorous than those grown in the open. In experiments with eggplants, 5 times as many sound fruits were obtained from plants grown on new ground as on old ground, and the decayed fruits were 16 per cent on new ground and 61 per cent on old ground. Different degrees of susceptibility to leaf blight (*Septoria lactucæ*) were observed in a number of varieties of lettuce. Nitrate of soda applied to the plats was without effect on the fungus or growth of the plant. In experiments conducted for combating cucumber anthracnose, Bordeaux mixture and soda Bordeaux mixture proved quite efficient. Experiments with beets were conducted to test the value of fungicides for controlling leaf spot (*Cercospora beticola*). But little disease was noticed where the plants had been sprayed with Bordeaux mixture or soda-Bordeaux mixture, while the attack on the other plats was not severe. In experiments with celery but little difference was observed on the shaded plats or where open culture was given and no difference in liability to fungus attack was observed.

Experiments with ornamentals (pp. 324–327).—Observations are given on some diseases, and methods of combating them, of violets, China asters, pinks, nasturtiums, mignonette, phlox, gladiolus, cannas, dahlias, ampelopsis, hibiscus, hollyhocks, Japanese redbud, peonies, and chrysanthemums.

Experiments with trees (pp. 334, 335).—A brief report is given of experiments with young chestnut trees. While in the nursery they were badly attacked by the fungus *Marsonia ochroleuca*. After transplanting and spraying 5 times with Bordeaux mixture they presented a much better appearance. The fungicides, however, seemed to burn the foliage to some extent. Similar treatment with hard maple seedlings was without effect in checking an unknown blight. Horse chestnut trees badly attacked by *Phyllosticta sphæropsoidea* were successfully sprayed with Bordeaux mixture, the sprayed trees being much healthier in appearance than those not so treated.

Experiments with fungicides (pp. 335, 336).—Formulas and methods of preparation are given for the fungicides referred to above.

Experiments with shading (pp. 337, 338).—The results of these experiments have already been referred to under the different crops and are noted elsewhere. (See p. 752.)

Experiments on old and new land (pp. 338–340).—These experiments have been referred to above. Gains were noted in the yield of wax beans, turnips, eggplants, peas, and tomatoes when grown on new land, and losses for tomatoes and cucumbers.

Notes on pea and bean root tubercles (pp. 340–343).—Experiments are reported in which the effect of soil inoculation of peas is shown. Peas were planted upon soil where no leguminous plants had grown for at least 8 years. Portions of the plat received a dressing of soil that had recently borne peas. At harvest 10 plants were taken at random from the treated and untreated plats and the tubercles counted, the result being that there were nearly 10 times as many tubercles on the roots of treated vines as on the untreated vines. The presence of root tubercles on plants from the untreated plats is said to indicate a prolonged vitality of the germs. Observations made upon the second crop showed an almost total absence of tubercles, due doubtless to the different conditions of temperature or the presence of sufficient combined nitrogen. Differences are also noted between the tubercles occurring on the roots of beans and peas.

Experiments with asparagus rust (pp. 343–348).—A bulletin has been issued by the station on this subject (E. S. R., 10, p. 650), in which the information here given is reported.

Experiments with sweet potatoes (pp. 348–351).—In continuation of previous investigations (E. S. R., 10, p. 449) the method of applying sulphur and kainit was studied, from which it was ascertained that sulphur will check soil rot while kainit also has a beneficial influence. It is claimed that when these fungicides are sown broadcast at the rate of 300 or 400 pounds per acre, a good crop of sweet potatoes may be grown on badly contaminated soil.

Experiments with pear blight (pp. 352–354).—A progress report is made on an investigation of this disease (E. S. R., 10, p. 449). While no very definite results have been obtained, summer-pruned trees gave the better yield in the pruning experiments, and in the culture experiments the well-cultivated trees receiving barnyard manure gave the largest returns.

Experiments with peach-root galls (pp. 354–357).—Negative results were obtained in experiments conducted to test soil conditions as related to root knot. Similar results were obtained in experiments where fungicides were added to the soils, no galls having appeared on any of the check plants.

The forcing of peaches (pp. 357–359).—The author notes the premature ripening of peaches in a number of localities, which is thought to be due probably to the cause which produces what is known as peach yellows (E. S. R., 3, p. 485).

Fungi as related to weather (pp. 359–370).—The substance of this article was presented before the Section of Horticulture and Botany of the Association of American Agricultural Colleges and Experimental Stations at its twelfth annual meeting.[1] In general it is shown that severe attacks of a large number of fungus diseases may be expected in seasons having a relatively high humidity.

Mildew of Lima beans, W. C. STURGIS (*Connecticut State Sta. Rpt. 1898, pp. 236–241*).—In continuation of a report on the disease of Lima beans, published by the station in 1897 (E. S. R., 10, p. 296), cooperative experiments have been conducted, in which it was sought to test the difference between thick and thin planting and upright and slanting poles, as regards the prevalence of mildew.

From the results tabulated there appears to be no difference whatever due to the position of the poles, and the difference in stand did not seem to materially affect the presence of the disease. It is stated that experimental rows ran in such a way that the soil at one end of every row was decidedly more moist than at the other. If this had been foreseen the rows would have been run in a different direction, so that there would not have been a possibility of infection at the lower end of each row.

The investigations do not warrant any conclusions, but serve to emphasize the importance of selecting high, well-drained land for the culture of Lima beans, and indicate that wet soil tends to induce the spread of mildew to a degree which no cultural methods will wholly counteract.

Some common diseases of melons, W. C. STURGIS (*Connecticut State Sta. Rpt. 1898, pp. 225–235*).—It is stated that the growing of melons in southern Connecticut for several years has been attended with very discouraging results owing to the attack of a number of diseases, which led the author to make an investigation as to the nature of the trouble and possible means of prevention.

The first disease considered is that which has been previously described by E. F. Smith, of this Department, as the bacterial wilt of melons.[2] This disease is said to be caused by *Bacillus tracheiphilus*. The author describes the disease at considerable length and finds associated with it, as previously suggested, a species of Fusarium to which part of the wilt disease is probably due.

---

[1] U. S. Dept. Agr., Office of Experiment Stations Bul. 65; also E. S. R., 10, p. 712.

[2] The original publication and description of this disease was given in Centbl. Bakt. u. Par., 2. Abt., 1 (1895), No. 9–10, pp. 364–374.

The second disease, which has been under consideration for several years, causes serious injuries to muskmelons. It is a black mold occurring in circular patches on the leaves and is known as *Alternaria brassicæ nigrescens*. This fungus was previously noted (E. S. R., 8, p. 411).

The third trouble seems to be a physiological one and follows the sudden disturbance of the equilibrium between water absorption and evaporation.

Experiments for the prevention of these different diseases were conducted with Bordeaux mixture, potassium sulphid, sulphur, and laurel green, the latter a combined fungicide and insecticide said to contain 10 per cent of copper and 3.75 per cent of arsenic. The application of sulphur to the leaves of melons is not to be recommended. Although it has some value as a fungicide, it tends to seriously burn the leaves. The susceptibility to the bacterial wilt seemed to be unaffected by the presence of fungicides. Dilute Bordeaux mixture and potassium sulphid are both regarded as efficient preventives for the blotching of melon leaves by the fungus Alternaria. The results obtained with laurel green used as a fungicide were unfavorable, and the author does not feel warranted to recommend its use. For the prevention of the physiological trouble of which mention has been made, the author recommends that when melons are grown upon loose sandy soil, it is advisable to apply fertilizers in small amounts at intervals throughout the season or until the spread of the vines makes tillage no longer practicable. In this way the vigor of the vines may be maintained, and they will be more resistant not only to disturbance in the physiological equilibrium, but to fungus attacks likewise.

Preliminary notes on two diseases of tobacco, W. C. STURGIS (*Connecticut State Sta. Rpt. 1898, pp. 212–260*).—Notes are given on the so-called "calico" or "mottled top" of tobacco, and a second disease called "spotting" of tobacco. The calico or mottled top, which the author considers different phases of the same disease, is very common in certain portions of the tobacco regions of Connecticut. The characteristics of the diseases are pointed out, the calico being characterized by a mottled appearance of the leaves, at first almost imperceptible, but soon spreading in blotches all over the leaf surface, the contrasted shades of green being very noticeable. The effect of soil conditions on this disease was investigated, and it was found most abundant in the close clay soils on the east side of the Connecticut River and more sparingly in other localities. Varieties and methods of culture were investigated without obtaining any definite conclusions. The application of fertilizers to the tobacco fields was studied, and it was found that where barnyard manures were extensively used disease was usually present, while where chemical fertilizers were used almost exclusively there was little disease. This does not warrant the statement, however, that the fertilizer is responsible for the presence or absence of the disease, since exceptions are noted where applications of both kinds of fertilizer had been made.

Experiments were conducted in which seeds from badly diseased plants were collected and grown in a hotbed, with the result that of 100 seedlings not one showed a trace of disease. This seems to indicate that the disease is not contagious, and as yet no direct information is known as to its infectiousness. As far as the author has been able to ascertain, it is not caused by insects, nematodes, or parasitic fungi, nor have bacteria been observed associated with it. He seems to think that the disease is a physiological one, caused primarily by sudden changes of atmospheric conditions disturbing the normal balance between evaporation of water from the leaves and its absorption by the roots, and secondarily by soil conditions which prevent the speedy restoration of that balance.

The spotting of tobacco is briefly described and it is said that when present to but a limited extent it results in giving the leaves an increased market value, but when badly affected, the tissues of the leaves are completely destroyed.

Notes are given on investigations of the mosaic disease and a spot disease which have been studied to a considerable extent by investigators abroad. In view of the possible identity of some of these diseases, it is deemed best to record such facts regarding them as experiments may show without generalizing from the rather uncertain character ot the evidence presented.

A bacterial disease of the sugar beet, CLARA A. CUNNINGHAM (*Proc. Soc. Prom. Agr. Sci., 1898, pp. 111-143*).—The author describes a disease of the sugar beet which appears to be not at all rare, at least in Indiana. The whole beet plant is attacked so that the diseased beets can be readily distinguished in the field. The outer and older leaves die early and the younger heart leaves become wrinkled, curled, and of a yellowish-green color. The root of a diseased beet shows no exterior indications of the disease, but when cut open striking differences are noticed in the appearance of the fibrous rings. The diseased root shows dark rings, quite different from the cream-colored ones of the healthy beet. When exposed to the air they become darker, sometimes becoming black after a few minutes.

Numerous cultures upon gelatin and agar have been made which seem to indicate that the trouble is due to bacteria. The behavior of the organism on the media is shown, and associated with it was a second germ that seemed to have nothing to do with the disease in question. The organism which is considered as the cause of the disease is a small, colorless bacillus, measuring 0.9 to 1.3μ in length, by from 0.5 to 0.8μ in breadth. In the beet tissue it is usually quiescent, but in cultures is motile. It is readily stained, but the presence or absence of flagella was not demonstrated. In most culture media an abundance of gas is formed which is shown to be composed of carbon dioxid, oxygen, hydrogen, and nitrogen, the last being 10 per cent or more of the total amount formed. Inoculations of healthy beets in the field and greenhouse appeared to transmit and set up the disease, although the results were not entirely conclusive.

The shot-hole effect on the foliage of the genus Prunus, B. M. DUGGAR (*Proc. Soc. Prom. Agr. Sci., 1898, pp. 64-69*).—The author calls attention to the shot-hole effect produced by a number of different fungi which attack leaves. A list is given of 12 species of fungi all of which produce a shot-hole effect on different species of Prunus, and 2 others are mentioned which do not cause this distinctive marking. From the number of species producing this effect the author was led to believe that it was the result of the reaction of the injury on the part of the host plant. Spraying experiments were conducted with quite a number of chemicals, among them formalin, picric acid, corrosive sublimate, and improperly-made fungicides, in all of which similar results were obtained. From these experiments and from other observations the author states that it is evident that the shot-hole effect of plums, peaches, cherries, etc., is a peculiar reaction of the plant to injuries such as may be produced by many fungi, by certain chemical reagents, and possibly by other causes. These injuries assume an economic importance not only from the point of view of fungus attacks, but also suggest special care in the application of copper compounds to the foliage of susceptible varieties.

Miscellaneous notes on plant diseases and spraying, W. C. STURGIS (*Connecticut State Sta. Rpt. 1898, pp. 261-267*).—Notes are given on *Monilia fructigena* on the peach, bacterial blight of Lima beans, damping-off of peas, relation between plant diseases and weather, a convenient method of preparing Bordeaux mixture in small quantities, and on some forms of spraying apparatus.

During 1898 an attack of unusual severity of Monilia on the peach was noted. In addition to peaches it was also abundant on the ornamental shrub known as the double-flowering almond. After destroying the blossoms, the fungus worked upon the twigs, killing the tissues and causing the leaves to wither. During the fruiting season another attack was noticed, the disease spreading widely and in conjunction with the scab fungus causing a very serious loss in the peach crop. It was thought that pruning and spraying the trees would probably have prevented the loss to a great extent.

A bacterial blight of Lima beans, due to *Bacillus phaseoli* (E. S. R., 9, p. 1058), is briefly described. Based on previous investigations it is thought that 2 sprayings, on July 15 and August 15, would probably have decidedly lessened the injury caused by it.

The damping-off of peas, which ordinarily does not cause serious damage in the open, is said to have greatly injured garden peas, in one locality to such an extent that it was a difficult matter to secure a crop. This disease, which is due to *Artotrogus* (*Pythium*) *debaryanus*, is briefly described, and it is suggested that thin planting and the use of chemical fertilizers, would greatly lessen the liability to loss.

The author discusses the relationship between weather and plant diseases, commenting upon the prevalence of disease in a wet autumn following a dry summer. A method is given for preparing Bordeaux mixture in 5-gallon quantities from previously prepared materials which, in the way suggested, may be kept for an indefinite time.

Notes are given on a number of forms of spraying apparatus which were tested at the station during the past season. The principle upon which the barrel pumps work has been previously described by this station (E. S. R., 10, p. 60). A form of spraying apparatus to be used with pails with a detachable kerosene tank is described at some length. It is stated that the tank can be removed and the aperture closed, after which it may be used for spraying fungicides, and it is well adapted for spraying plants on a small scale.

Rusts of horticultural plants, B. D. HALSTED (*Florists' Exchange, 13 (1900), No. 3, p. 60*).—A lecture before the Massachusetts Horticultural Society.

On the white rust of horse-radish and black salsify, WEISS (*Prakt. Bl. Pflanzenschutz, 2 (1989), No. 7, pp. 51, 52*).

On the prevention of apple scab, A. VON DER PLANITZ (*Prak. Ratgeber Obst u. Gartenbau, 1899, No. 30, p. 265*).

The canker fungus (*Bd. Agr. [London], Leaflet No. 56, pp. 7, figs. 2*).—Notes are given on *Nectria ditissima*, which causes what is known as canker on apple trees. A description and life history of the fungus is given and methods for its prevention described. Young trees should be examined for any signs of canker and infected parts cut out with a sharp knife or, where possible, branches should be cut away. A strong solution of copper sulphate applied in the late autumn or winter is also recommended. Apple trees should be kept free from the apple aphis, as these insects convey the spores from tree to tree. A number of diseases are described which are sometimes mistaken for canker, one of the most common being the fire blight due to *Bacillus amylovorus*.

Notes on a gum flow in fruit trees, C. JOKISCH (*Mitt. K. Gartenbau Gesell. Steiermark, 1899, No. 7–8, pp. 138, 139*).

Fungus parasitic diseases of the grapevine, A. A. YACHEVSKI (*St. Petersburg: Min. Agr. and Imp. Domains, 1899, pp. 2–83; rev. in Selsk. Khoz. i Lyesov., 194 (1899), July, p. 180*).

Recent investigations on black rot, A. PRUNET (*Rev. Vit., 1899, Nos. 292, pp. 110–115; 293, pp. 135–140*).

The occurrence of black rot on grapes, J. CAPUS (*Prog. Agr. et Vit. (Éd. L'Est), 21 (1900), No. 2, pp. 53–56*).—The author points out the relationship between the appearance of the black-rot fungus on grapes and the time of its occurrence on the leaves. The second invasion of the fungus on the leaves produces the first attack on the fruit, etc. It is believed that the most favorable time for applying the fungicides for this disease is prior to the first attack on the leaves, although applications should be made later in the season.

Results of experiments in combating black rot, G. DUFFOURC-BAZIN (*Prog. Agr. et Vit. (Éd. L'Est), 20 (1899), No. 39, pp. 357–360*).—Bordeaux mixture, copper sulphate, and Bordeaux mixture containing mercury were tested, 5 applications being given to the vines. The time of appearance of the different attacks of the fungus are given. The author states that the experiments show that absolute prevention of black rot is possible. In the vineyards covering 15 hectares where the fungicides were employed no trace of black rot was found, while in the checks there was not a sound leaf or grape at the end of the season.

Experiments in treating black rot in 1899 in Haute-Garonne and Bas-Armagnac, J. B. SENDERENS (*Prog. Agr. et Vit.* (*Éd. L'Est*), *20* (*1899*), *No. 44*, *pp. 501–511*).—A report is given of experiments conducted in a number of vineyards with 24 fungicides of different composition or strength for the prevention of black rot. The best results were obtained with a mixture composed of copper sulphate, soda carbonate, and water, containing 2 kg. of copper per 100 liters.

Fungus diseases resembling black rot, V. DUCOMET (*Prog. Agr. et Vit.* (*Éd. L'Est*), *20* (*1899*), *No. 36*, *pp. 276–285*, *pl. 1*).—The author describes a number of diseases of plants which bear a superficial resemblance to the black rot on the leaves of the grape. Among those described are leaf spots of various rosaceous plants, leaf spots of sycamore, parsley, pear, orange, violets, and strawberries. The fungi causing these different diseases are described, the time of their principal attack mentioned, and suggestions given for the prevention of the disease.

Ear cockle (*Jour. Agr. and Ind.*, *South Australia*, *3* (*1899*), *No. 5*, *pp. 431*, *432*, *fig. 1*).—A description is given of the attack of *Tylenchus scandens* on wheat. As a suggestion for the prevention of the spread of this pest it is recommended that all diseased grain be separated by floating in water prior to seeding.

A sugar-cane pest in Madras, C. BENSON (*Dept. Land Records and Agr.*, *Madras*, *Vol. II*, *Bul. 36*, *pp. 113–133*).—Notes are given on the cane disease caused by attacks of *Trichosphæria sacchari*. The symptoms of the disease and methods by which it is spread are described. It is stated that in Madras the method of rotation is such that the ground is practically in sugar cane continuously. Investigations have been made and the disease has been found present in every district in which sugar cane is cultivated to any considerable extent. The life history of the fungus is described at considerable length, as well as numerous fungi which are more or less related to it.

Concerning a bacteriosis of Dactylis glomerata, E. RATHAY (*Sep. Sitzber. Math. Naturw. Cl. K. Akad. Wiss.* [*Vienna*], *108* (*1899*), *I*, *pp. 6*).

On the best time for the treatment of Oidium, A. LAURENT (*Prog. Agr. et Vit.* (*Éd. L'Est*), *20* (*1899*), *No. 46*, *pp. 252*, *253*).—The author states that 2 applications of sulphur in April and May and 1 during June, July, and August are sufficient for preventing attacks of mildew under ordinary conditions.

Recent observations on combating Peronospora and Oidium, E. MAYER (*Ber. Verhandl. 17 Deut. Weinbaukongress*, *Mainz*, *1899*, *pp. 58–74*).

The peronospora of beets, P. VOGLINS (*Extr. Ann. R. Accad. Agr. Torino*, *42* (*1899*), *pp. 11*, *pl. 1*).—Gives description and notes on *Peronospora schachtii*.

A disease of sycamores in the Luxemburg gardens, A. GIRARD (*Compt. Rend. Soc. Biol. Paris*, *11. ser.*, *1* (*1899*), *No. 23*, *pp. 565*, *566*).—Notes are given on *Glœosporium nervisequum*.

The red rot of spruce, C. BOMMER (*Bul. Soc. Cent. Forst. Belg.*, *6* (*1899*), *No. 8*, *pp. 553–567*).

A new disease of azaleas, J. VOGLINO (*Malpighia*, *13* (*1899*), *pp. 73–86*; *abs. in Bot. Centbl.*, *80* (*1899*), *No. 8*, *pp. 313*, *314*).—Notes a very destructive disease due to *Septoria azaleæ*, which is described as new.

ENTOMOLOGY.

Report of the government entomologist for the year 1898, C. P. LOUNSBURY (*Dept. Agr.*, *Cape Good Hope*, *1899*, *pp. 64*, *pls. 9*).—In this report the author has summarized the work of the government entomologist, and gives an account of the assistance which the government is rendering in the way of combating injurious insects. Some progress is reported of cooperation of private individuals with the government for this purpose. In Cape Colony fumigation by means of hydrocyanic-acid gas has been carried on largely by certain companies which have undertaken the work. The extent of such fumigation is steadily being increased and good results have been reported. The entomologist has devoted some attention to the collection and distribution of vedalia. Numerous packages of this insect have been prepared and sent to various addresses. An attempt was made to introduce from Ceylon specimens of *Chilocorus circumdatus*, but without success. A similar unsuccessful attempt was made at introducing *Orcus chalybeus* from New South Wales. The office succeeded in sending live specimens of *Exochomus nigromaculatus* to Ceylon and to New South Wales. The practicability of introducing hymenopterous parasites of scale insects is discussed, as well as the question of importing fungus diseases of these insects.

Biological and economic notes are given on a large number of insects which proved injurious during the season. Among these injurious insects various scales occupy a prominent place. Besides scales we may mention the following as especially injurious: Codling moth, fruit fly (*Ceratitis capitata*), *Phlyctinus callosus*, species of ticks, the woolly aphis, the cabbage plutella, the bollworm, the quince borer (*Cossus tristis*), and species of locusts. The majority of these insects are figured and a general index is appended to the report.

Report of the entomologist, J. B. SMITH (*New Jersey Stas. Rpt. 1898, pp. 373-467, figs. 15*).—In the general part of the report the author gives an account of his experiences during the year with a large number of miscellaneous insects which proved more or less injurious.

The author purchased a plat of land on which were set out 50 fruit trees, most of them being infested with the San José scale, and 2 rows of currant bushes, also infested. This orchard was treated during the year in the way in which the author believes the ordinary fruit culturist treats his own fruit trees. Experiments were tried with a number of insecticides for the destruction of the San José scale, among them pure kerosene, crude oil, and a mechanical mixture of kerosene and water, and whale-oil soap. The crude oil and even the kerosene were found not to cause serious damage to the trees when applied with care. Detailed notes are given of the appearance and behavior of each tree during the whole experiment.

A dwarf Duchess pear badly infested with San José scale was thoroughly painted with crude petroleum from the topmost bud to the surface of the ground. The color of the bark was changed and the tree appeared to be seriously injured at first. All the scales were destroyed and later in the year the tree did as well as other trees and finally came out of the experiment uninjured.

Peach trees were treated in the same way without suffering any injury. A kerosene resin wash made in the following proportions was tried: 1 oz. of resin for every 75 cc. of kerosene. The solubility of resin in kerosene, expressed in ordinary terms, is 1 oz. in 2½ ozs. kerosene; or, about 3 lbs. in 1 gal. When used in this full strength peaches and some plums showed considerable injury. In general, the results did not encourage the use of this mixture.

An orchard of mixed fruits was treated for San José scale with undiluted kerosene. The first application was made September 30 by means of a Vermorel nozzle. The Bartletts were sprayed again in December; altogether 2,244 trees were sprayed with 185 gal. of kerosene. The four-year old trees received each about 1 pt. of kerosene. The Bartletts endured 2 applications without injury and the applications before January 1 produced absolutely no bad result.

The author has experimented with a mixture of kerosene and water, and comes to the following conclusion regarding its use: The mechanical mixture of kerosene and water, as applied by means of the Deming sprayer, has proved itself exceedingly useful against the San José scale. At the rate of 1 part kerosene to 5 parts water, it killed the young scales and did not in the least harm any tree to which it was applied. Even peaches could be drenched with it repeatedly without marked injury. In the use of whale-oil soap, the author found 1 lb. to 1 gal. of water produced a slight scorching but no real injury, and that the effectiveness of a mixture of 2 lbs. whale-oil soap and 1 gal. of water was no greater than a mixture of half that strength. The addition of lime to whale-oil soap was found to render it entirely ineffective.

The work of the year upon the San José scale showed that in some cases a mechanical mixture of kerosene and water in the proportion of 1:5, when applied about the middle of June, destroyed all the scales upon a large proportion of the trees. In New Jersey there is said to be three full and a partial fourth brood of the scale. The larval swarm is most numerous in September and October, and the greatest danger from the spread of the insect occurs at that time. The author states that where trees are only moderately infested the kerosene and water mixture gives the best results when sprayed upon the trees about June 15, with another application a few days later. The fungus disease *Sphærostilbe coccophila* is reported as present in New Jersey to some extent and as a help in the destruction of the scale. The importation of the Japanese coccinellids (*Chilocorus similis* and *C. tristis*) was apparently unsuccessful.

Brief notes are given on the occurrence and life history of the periodical cicada in New Jersey.

The author relates the life history and appearance of the strawberry-leaf roller (*Phoxopteris comptana*), and recommends for the destruction of this insect a thorough spraying with arsenate of lead at the rate of 15 oz. in 80 gal. of water about the middle of May; or, as a substitute for arsenate of lead, Paris green may be used at the rate of 1 lb. in 150 gal. of water. If the bed is new and is to remain for another year, the plants could be mowed down immediately after berry picking and burned in order to destroy the insect in the larval or pupal stage.

An account is given of the history of the common asparagus beetle (*Crioceris asparagi*) and of the 12-spotted asparagus beetle (*C. 12-punctata*). Among the natural enemies of the common asparagus beetle are mentioned *Stiretrus anchora* and *Megilla maculata*. As remedies the author suggests the destruction of all volunteer asparagus in the field and permitting a certain number of young shoots in each bed to grow as traps for the eggs and their subsequent destruction. The larvæ may also be destroyed with fresh air-slaked lime. The same remedies are recommended for the 12-spotted asparagus beetle.

The tulip soft scale (*Lecanium tulipiferæ*) is reported as gradually increasing and as being an important enemy of the tulip tree. The insect is described and figured and the methods of its distribution from one tree to another are suggested. *Lætilia coccidivora* is reported as being an effective destroyer of this scale. The author states that the insecticide applications should be made preferably in September. Spraying with a mechanical mixture of kerosene and water is said to be very effective against this insect as well as undiluted kerosene, but the latter remedy is more apt to injure the tree.

Entomological notes, W. E. BRITTON (*Connecticut State Sta. Rpt 1898, pp. 269–275*).—Brief notes are given on injuries caused by the squash ladybird. *Macrobasis unicolor* is reported as injuring *Genista tinctoria*. *Serica trociformis* is said to have eaten the foliage of the hornbeam. The elm-leaf beetle is reported as injurious during the year. *Xyleborus dispar* was found in the trunks of plum trees. The oak pruner is reported as having caused considerable damage to oak trees. Experiments were conducted in spraying fruit trees with pure kerosene oil for the San José scale. The insects were killed and little damage was done to the trees where the application was not heavy. One Japan plum tree, which was badly incrusted with scale, was thoroughly drenched with kerosene with the result that the branches of the tree were badly killed back. Brief notes are given on the habits of the following insects: Elm scale, oyster shell bark louse, scurvy bark louse, rose scale, tulip scale, *Schizoneura pinicola*, pear psylla, zebra caterpillar, *Gortyna nitela*, and Angoumois grain moth.

Trials against larvæ of the May beetle, 1898, O. HÖFFDING (*Tidsskr. Landökon., 1899, No. 8–9, pp. 369–401*).—The trials were conducted for the purpose of ascertaining whether attacks of May beetles (*Melolontha vulgaris*) can be minimized or prevented by the application of special fertilizers. Four different farms cooperated in the trials. Superphosphates, nitrate of soda, and kainit were applied singly and all three together. The results showed that none of the materials was able to kill the larvæ of the beetle during the wet season of 1898, nor cause them to remain deeper in the ground and thus below the roots of cultivated plants. One-sided fertilization or very heavy application of the complete fertilizers did not reduce the depredation of crops by larvæ in the seasons of 1897 and 1898 to such an extent as to make the use of fertilizers for that purpose profitable.—F. W. WOLL.

The bont tick (Amblyomma hebræum), C. P. LOUNSBURY (*Agr. Jour. Cape Good Hope, 15* (*1899*), *No. 11, pp. 728–743, fig. 1*).—In this article the author presents an account of the appearance, habits, life history, and distribution of the bont tick. This tick has been found upon all kinds of stock, as well as upon ostriches and man. The female, when fully distended with blood, drops to the ground, and after a short period begins the deposition of the eggs. The number of eggs which are laid by a single female varies from 11,000 to 17,000, and from 3 to 9 weeks are required for their deposition. The larval ticks are 6-legged and gather upon grass tops, from which places they make their way to passing animals. These larvæ, after fully distending themselves with blood, drop to the ground, when molting occurs, and the tick passes into the nymph stage. The nymphs in turn find their way to the skin of domestic animals, where they become gorged with blood and then drop off. After another molting the tick passes into the adult stage. It was shown that these ticks may live for 3 months without food.

American vines and the phylloxera situation in the Canton de Vaud (*Les vignes américaines et la situation phylloxérique dans le Canton de Vaud. Sup. Chron. Agr. Cant. Vaud, 1899, pp. 110, figs. 7*).—This paper is a report of the viticultural station of Lausanne. A general account is given of the introduction of the phylloxera upon American vines and of the subsequent struggle of the vineyardists with this insect. At the present time large areas of vineyards in France, Spain, Hungary, Italy, and Switzerland have been reset with grafted stock, the stock being of American origin. An account is given of the practices adopted for the propagation and culture of American stock, of the process of grafting, and of the growth, development, and vigor of grafted vines. In the Canton de Vaud the adoption of American stock has not been as general as in many other localities. It is recognized that the process adopted is an inconvenient and laborious one, and some vine growers have preferred the extermination of their vineyards and resetting with native stock rather than adopt American stock and thereby allow the phylloxera to remain in the soil. The complete annihilation of the phylloxera, however, is such a difficult matter and requires so long a delay to insure its successful accomplishment that the adoption of American stock is urgently recommended for certain localities in this Canton.

Insects detrimental and destructive to timber and timber products, A. D. HOPKINS (*Proc. Soc. Prom. Agr. Sci., 1898, pp. 103–108*).—The author classifies the chief insects which are destructive to timber under 2 groups, bark miners and wood miners.

Notes are given on the habits and economic importance of the following scolytid bark miners: *Dendroctonus frontalis, D. simplex, Scolytus* *quadrispinosus*, *Pityophthorus minutissimus*, and *Polygraphus rufipennis*. Under the head of buprestid or flat-headed bark borers the author treats briefly of *Melanophila fulvaguttata* and *Agrilus bilineatus*. Brief notes are given on the following wood miners: *Lymexylon sericeum*, *Eupsalis minuta*, and *Corthylus columbianus*.

Among the insect enemies of timber the author considers the 2 following species: *Lyctus striatus* and *Phymatodes variabilis*.

In order to control the destructive activity of timber insects the author concludes from a long experience that—

> "By slight changes in the method of cutting, manufacturing, and marketing timber and timber products, the conditions will be rendered unfavorable for the attack of insects, and that, owing to the fact that most timber-infesting insects prefer to attack sickly or recently felled trees, their depredations on the more valuable living timber can often be prevented by simply girdling or cutting a few inferior trees at the proper time each year. These so-called trap trees will attract the insects, and after their eggs are deposited and hatched, the young may be destroyed by removing the bark or burning the trees."

Quarantine against foreign insects—how far can it be effected? J. B. SMITH (*Proc. Soc. Prom. Agr. Sci., 1898, pp. 90–100*).—The paper is in the nature of a discussion of the proposed national inspection law for nursery stock. The author calls attention to the great difficulty which inspectors must experience in detecting various insects when present upon nursery stock. The fact that insects may be found upon all parts of plants which may not be connected with any agricultural industry, under the bark, in the packing, and in wood, renders it practically impossible for any inspector to give a certificate which is entirely reliable.

The author believes, nevertheless, that such a law will have the good effect of making nurserymen and shippers more careful than they otherwise would be, and thus perhaps prevent the importation of some injurious insects.

The most injurious insects which have been imported from foreign countries have got into the country in quite unexpected ways and under circumstances that would have rendered their detection impossible by inspection.

History and present condition of sericulture in the world, D. ROSSINSKI (*Selsk. Khoz. i Lyesov., 195 (1899), Nov., pp. 257–283*).—This article includes the following items: Historical outline of silk culture; origin of the mulberry silkworm; beginning of its domestication; silk culture of Asia, western Europe, southern Russia, and northern Russia; geographical and statistical outline of sericulture in China, Italy, France, western Europe, Africa, America, Caucasus, and Turkestan; and the industries which are related to silk culture.

Bibliography of clinical entomology, J. C. HUBER (*Bibliographie der klinischen Entomologie. Jena, 1900, pt. 4, pp. 27*).—This part contains a list of literature upon *Sarcoptes scabiei* from 1786–1900, with additional lists of literature on related diseases of animals, and an appendix on *Symbiotes felis*.

Insect migration between Germany and the United States, L. KRÜGER (*Insekten-Wanderungen zwischen Deutschland und den Vereinigten Staaten. Stettin, 1899, pp. VIII+174*).—This work constitutes an elaborate digest of the literature on the migration of insects between the two countries named. In the author's opinion no American insect of economic importance has established itself in Germany and no such occurrence is likely to take place. The author believes that the differences in climate of the two countries will tend to prevent it.

Extensive bibliographical and economic notes are given on more than 80 species of injurious insects, with special reference to their original home and subsequent distribution.

Migration and dispersal of insects. Lepidoptera, J. W. TUTT (*Ent. Rec. and Jour. Variation, 11 (1899), No. 12, pp. 319–324*).—Observations upon a number of species of butterflies and moths.

The histogenesis of the imaginal muscles of the Hymenoptera, J. ANGLAS (*Compt. Rend. Soc. Biol. Paris, 11. ser., 1 (1899), No. 36, pp. 947–949*).—An anatomical study of the metamorphosis of bees and wasps.

Annual report for 1899 of the zoologist, C. WARBURTON (*Jour. Roy. Agr. Soc. England, 3. ser., 10 (1899), pt. 4, pp. 667–678, figs. 5*).—This report contains notes on the habits, life history, and remedies for *Gastrophilus hæmorrhoidalis, Coccinella 7-punctata, Diplosis pyrivora, Carpocapsa pomonella, Hoplocampa testudinea, Coleophora nigricella, Chermes laricis,* and *Zeuzera æsculi.*

Report of the State Entomological Station of Sweden for 1898, S. LAMPA (*Meddel. K. Landtbr. Styr., 1899, No. 53, pp. 70*).

Report of the State Entomologist for 1898, W. M. SCHÖYEN (*Aarsber. Offent. Foranst. Landbr. Fremme, 1898, pp. 75–106*).

General index to Miss Ormerod's reports on injurious insects, 1877-1899, R. NEWSTEAD (*London, 1899, pp. 58*).—Contains a general index, a plant index, and an animal index.

Report on the injurious insects of Finland for the year 1898, E. REUTER (*Landtbr. Styr. Meddel.* [*Helsingfors*], *1899, No. 26, pp. 68*).—This report contains economic and biological notes on a number of injurious insects, among which may be mentioned *Charæas graminis, Tortrix paleana, Agriotes obscurus, Hadena secalis, Agrotis segetum, Meligethes æneus, Plutella cruciferarum, Athalia spinarum, Carpocapsa pomonella, Argyresthia conjugella,* and *Nematus ribesii.*

The author made a number of experiments with insecticides upon *Charæas graminis,* during which he employed the following substances: Antinonnin, one part in 500 parts of water, lysol in various strengths, and Paris green.

In combating the codling moth the author used Paris green sprays in various proportions, and concludes from his work that trees should be thoroughly covered with the spray, but not to such an extent that the liquid will drip from the trees.

Detailed notes are given of the distribution and life habits of *Argyresthia conjugella.*

Insects injurious to cereals, V. MAYET (*Prog. Agr. et Vit., 16 (1899), No. 51, pp. 715–719*).—Notes on *Siphonophora avenæ, S. cerealis, S. granaria* (which are considered distinct species by the author), *Forda vacca,* and *Pemphigus boyeri.* The first three named species are parasitized by *Aphidius avenæ.* On small plats of cereals the author used a 2 to 3 per cent solution of tobacco and soap in water. *F. vacca* and *P. boyeri* attack the roots of cereals. Remedies which are effective against phylloxera may also be used against these insects.

Injurious insects of the garden and greenhouse, and means of destroying them, D. KARAMZIN (*St. Petersburg, 1899, pp. 84, ill.*).—The author's articles published in "Derevnya" for the current year are brought together in book form.

Tabulated list of orchard insect pests affected by spraying, F. V. THEOBALD (*London, 1899, pp. 19*).—A list of injurious insects with the date of appearance of eggs and larvæ, formulas for preparing insecticides, and directions for their application.

Insects attacking the Spanish or sweet chestnut, F. V. THEOBALD (*Jour. Southeast. Agr. Col., Wye, 1899, No. 8, pp. 46–54, figs. 4*).—This article contains an account of the habits, life history, and remedies for the following insects: *Porthecia* *auriflua, Fumea nitidella, Tortrix viridana, T. dumetana, T. ribeana, Lozotænia rosana, Carpocapsa splendana, Coleophora lutipennella Attelabus curculionides*, and *Smynthurus fusca*.

The clay-colored weevil, F. V. Theobald (*Jour. Southeast. Agr. Col., Wye, 1899, No. 8, pp. 40–46, figs. 3*).—Notes on *Otiorrhynchus picipes*. This insect causes injury to peas, beans, turnips, kale, vines, raspberries, apples, plums, elms, etc. It feeds upon the leaves and also the wood. The larvæ hatch from eggs which are deposited in the ground and live through the winter. The adults appear in May and June. Among the natural enemies of this insect the author mentions *Cerceris arenaria* and *C. labiata*.

It is recommended that the weevils be jarred from the plants which they infest and be caught by means of tarred boards or other receptacles. Against the larvæ the following spray was found effective: Carbolic acid and water in the proportion of 1 pint of crude carbolic acid to 10 gal. of water.

The codling moth and means of combating it, Y. Treiner (*St. Petersburg: Dept. Agr., 1899, pp. 16, figs. 5*).—A discussion of the habits and life history of the moth and of the use of insecticidal sprays against it.

The pear and cherry sawfly, Eriocampa limacina (*Jour. Bd. Agr.* [*London*], *6* (*1899*), *No. 3, pp. 341–345, fig. 1*).—A brief account of the appearance and life history of this species. In combating the insect it is recommended that the ground under infested trees be thoroughly cultivated and that quicklime be scattered upon the ground and cultivated in. Paraffine emulsion is also said to be effective. The emulsion is made by dissolving a half pound of soft soap in a gallon of boiling water, then adding 2 gal. of paraffine oil, and subsequently churning the mixture together.

Some recent developments in the San José scale problem in Ohio, F. M. Webster (*Proc. Soc. Prom. Agr. Sci., 1898, pp. 112–119*).—This paper is an abbreviated and somewhat altered form of Ohio Station Bulletin 103 abstracted in E. S. R., 11, p. 267.

The Hessian fly, M. Bartlet (*Rpt. Farmers' Inst. Manitoba, 1899, pp. 41–43*).—A brief account of the habits and life history of this insect.

Some problems connected with the attacks of Jassidæ upon grasses, H. Osborn (*Proc. Soc. Prom. Agr. Sci., 1898, pp. 101, 102*).—This is an abstract of an article read by the author in which he calls attention to the problems in connection with this family of insects, which are awaiting a solution.

Among the problems which the author considers important are the geographical distribution of the different species, range of food plants for each species, determination of the number of annual generations, and the time of occurrence of each stage.

Communication on a second generation of Vanessa io, M. Ude (*Ent. Nachr., 25* (*1899*), *No. 23, p. 366*).

Rocky Mountain locusts, H. McKellar (*Rpt. Farmers' Inst. Manitoba, 1899, pp. 38–41*).– Notes on *Melanoplus spretus* and *M. atlanis*.

Notes on the New Zealand Acrididæ, F. W. Hutton (*Trans. and Proc. New Zealand Inst., 31* (*1898*), *pp. 44–50, pl. 1*).

Revision of the New Zealand Phasmidæ, F. W. Hutton (*Trans. and Proc. New Zealand Inst., 31* (*1898*), *pp. 50–59*).

The Bugong moth (Agrotis infusa), W. W. Froggatt (*Agr. Gaz. New South Wales, 10* (*1899*), *No. 12, pp. 1252–1256, map 1*).—A description of the food plants and life history of this insect. Among the remedies recommended, mention may be made of the ditch and pit method, the use of a heavy roller and Paris green spray on trap crops. A fungus disease was discovered which assisted materially in the control of this insect and has been determined by M'Alpin to be a new species which has been named *Entomophthora australis*.

Three galls found on the yew, F. V. Theobald (*Jour. Southeast. Agr. Col., Wye, 1899, No. 8, pp. 54–58, figs. 4*).—Brief notes on *Phytoptus taxi, Chermes taxi,* and *Cecidomyia taxi*.

An attack of Crepidodera rufipes on tares, F. V. THEOBALD (*Jour. Southeast. Agr. Col., Wye, 1899, No. 8, pp. 38–40*).—Brief notes on the life history of this insect and a few related species.

The Oxyopisthinæ, H. J. KOLBE (*Stettin. Ent. Ztg., 60 (1899), No. 1–6, pp. 3–138*).—The author establishes a new group of snout beetles of the subfamily Calandridæ. New species are described.

The digestive organs of Periplaneta orientalis and Blatta germanica, A. PETRUNKEWITSCH (*Zool. Jahrb., Abt. Anat., 13 (1899), No. 1, pp. 171–190, pl. 1, fig. 1*).—An anatomical and physiological study of these insects, with an extensive bibliography.

Life habits of Porthetria dispar, H. GAUCKLER (*Illus. Ztschr. Ent., 4 (1899), No. 23, p. 361*).

Notes on the Pyralidæ, P. C. T. SNELLEN (*Tijdschr. Ent., 42 (1899), No. 1–2, pp. 58–95, pls. 2*).—Descriptive and biological notes on a number of species of this family.

Habits of the imago of Smerinthus ocellatus, L. J. LAMBILLION (*Ent. Rec. and Jour. Variation, 11 (1899), No. 12, pp. 330, 331*).—Notes on the egg-laying habits of this insect.

Tinea granella, V. MAYET (*Prog. Agr. et Vit., 16 (1899), No. 52, pp. 735–737*).—A description of this insect, with an account of its habits and life history. Species of Hemiteles and Campoplex, as well as the mite *Sphærogyna ventricosa* are mentioned as natural enemies of this insect.

On the habits of Dermestes vulpinus, A. T. POTTER (*Trans. and Proc. New Zealand Inst., 31 (1898), pp. 104–105*).—This insect is reported as injurious to bones and wood. The eggs hatched within 4 to 5 days and the pupal stage lasted 13 days.

Pediculoides ventricosus, BRUCKER (*Compt. Rend. Soc. Biol. Paris, 11. ser., 1 (1899), No. 37, pp. 953–955*).—Mites of this genus have been found parasitic upon the larvæ of insects and on man. The forms found under these different conditions have been considered different species. The author examined specimens which came from the larvæ of Callidium and from man and came to the conclusion that they belonged to one species, and that its normal host is an insect larva.

Collops bipunctatus as an enemy of the Colorado potato beetle, C. E. MEAD (*Amer. Nat., 33 (1899), No. 396, pp. 927–929*).—This insect is reported as feeding upon the eggs and larvæ of the Colorado potato beetle of New Mexico.

Mustard dross and its effect on wireworm, F. V. THEOBALD (*Jour. Southeast. Agr. Col., Wye, 1899, No. 8, pp. 31–35*).—In this article the author describes some experiments which were conducted for the purpose of determining the value of mustard dross in preventing the ravages of the wireworm. The results obtained indicate that this substance is worthless for preventing the attacks of wireworms, and is distinctly harmful, since it appears to be favorable to the multiplication of wireworms and destroys or drives away the earthworms.

A new method of disinfection by means of formaldehyde, C. ENOCH (*Hyg. Rundschau, 9 (1899), No. 25, pp. 1274–1283*).

FOODS—ANIMAL PRODUCTION.

Studies on bread and bread making, H. SNYDER and L. A. VOORHEES (*U. S. Dept. Agr., Office of Experiment Stations Bul. 67, pp. 52, figs. 3, pls. 2*).—This includes two separate papers.

Studies on bread and bread making at the University of Minnesota in 1897 and 1898, H. Snyder (pp. 7–36).—The author's experiments have to do with the composition of a number of samples of Minnesota bread and flour as compared with their cost; the loss of dry matter, carbon, and nitrogen in bread making; the production of soluble carbohydrates and acids; the behavior of proteids; and the changes in the solubility of fat during bread making. Two experiments on the digestibility of bread made from patent roller process flour and bakers' grade flours are also reported.

"The results of these investigations may be summarized as follows:

"(1) In ordinary bread making about 1 per cent of carbon dioxid was given off during the rising and baking processes and a little more than 1 per cent of alcohol was formed. There was also given off during baking a small amount of volatile acid products.

"(2) The determination of the volatile products given off during bread making showed a total loss of 0.74 per cent of the total carbon in the flour, which is equivalent to about 1.68 per cent of starch.

"(3) When special care was taken in bread making, the analyses of the flour and the bread showed an average loss of 1.58 per cent of the total dry matter of the flour.

"(4) The analyses of the gases produced, and of the flour and bread, indicate that for good bread making the total losses need not exceed 2 per cent of the flour used, and that it is possible to reduce the losses to 1.1 per cent.

"(5) The amount of alcohol recovered in bread making was found to be less than the theoretical amount corresponding to the carbon dioxid produced. This discrepancy is not due to alcohol remaining in the loaf, since no appreciable amounts of alcohol were recovered from fresh bread. When alcohol was used in making bread, the action of the yeast was apparently normal.

"(6) In bread making the starch undergoes both physical and chemical changes. From 3 to 4 per cent of soluble carbohydrates were found in the bread, indicating that less than 8 per cent of the total starch was changed from insoluble to soluble forms. The physical changes which many of the starch granules undergo are marked. Some are partially disintegrated, while others are ruptured.

"(7) Normal flour contains a small amount of acid. During bread making variable amounts of acid were produced by the action of the yeast. A part of the acid formed appears to unite with the proteids. In acid doughs the acid renders the proteids more soluble and changes the composition of the gluten.

"(8) When bread was made from dough of low acidity there was less water-soluble nitrogen in the bread than in the flour, because of the coagulation of the albumin and globulin during baking. In bread made from doughs of high acidity the amount of water-soluble nitrogen was increased. This is due to the action of the acid on the insoluble proteids. The gliadin is rendered soluble, which changes the gliadin-glutenin ratio of the bread.

"(9) The power of expansion which the gluten of a flour possesses determines very largely the physical properties of the bread. Some glutens possess an expansive power four or five times greater than others.

"In general it may be said that in good bread making the loss of dry matter and of nitrogen need not exceed 1.6 per cent of the total amounts in the flour. In poor bread making the losses may exceed 6 per cent. In good bread making the losses are equivalent to about 3 lbs. per barrel of flour, while with poor bread making the losses may exceed 12 lbs. per barrel."

Losses in the process of making bread, *L. A. Voorhees* (pp. 37–51).—A number of experiments were made to study the loss of material which has been observed in making and baking bread.

"[From the results obtained] it seems proper to conclude that at high temperatures there is a partial volatilization of the vegetable fat in bread making, especially in the presence of escaping water vapor, and, in addition, an oxidation of the residual organic matter. When animal fat was added to the dough there seemed to be an occlusion of fat, probably due to the formation of dextrin. . . .

"From the investigations reported in this bulletin it is evident that some of the apparent loss of ether extract in bread making was due to heat employed in baking the bread and to the heat employed in drying the samples for analysis.

"When samples of flour, dough, and bread were dried in air or in hydrogen previous to analysis, an apparent loss of ether extract was observed. It should be remembered, however, that since ether extract is usually determined in a sample used for determination of dry matter, the materials have been subjected to two dryings, one previous to analysis and one during analysis. When samples of flour and dough dried over sulphuric acid were analyzed there was also an apparent loss of fat. The loss was, however, smaller than was the case when samples dried in air or hydrogen were analyzed. In this case the samples had been submitted to the action of heat but once; that is, in the determination of dry matter in the sample before extracting with ether. Samples of dough dried over sulphuric acid were extracted with ether without any further drying; that is, without submitting them to the action of heat. In this case slightly more ether extract was recovered than when similar samples were extracted after drying in an oven for the determination of dry matter. In all these cases, however, there was an apparent loss of ether extract; that is, when flour is made into dough and dried or baked, all the ether extract of the flour can not be recovered. . . .

"These considerations indicate that the usual custom of drying fodder and food samples in air or in hydrogen in a drying oven previous to extraction with ether should be carefully investigated in view of the possible errors in the estimation of ether extract involved."

Food products, A. L. WINTON ET AL. (*Connecticut State Sta. Rpt. 1898, pp. 103-223, pls. 2*).—The Connecticut pure food law is quoted, and detailed statements are made concerning foods and condiments examined in accordance with the law. The following table shows the total number of samples of different materials examined, as well as the number of samples in each case found to be pure, adulterated, and treated with preservatives (borax or salicylic acid) but otherwise not adulterated:

Number of samples of food products found to be pure, adulterated, and containing preservatives.

Food products.	Unadulterated.	Adulterated.	Contained preservatives.	Total.
Collected by the station—				
Purchased in Connecticut market:				
Jellies	27	43		70
Preserves, jams, marmalades, etc	6	45		51
Teas	89			89
Coffee	34	11		45
Coffee compounds	22			22
Coffee substitutes	6			6
Flour	25			25
Ginger	67	24		91
Malt liquors	35		12	47
Sausage	5		14	19
Honey	27	10		37
Maple sirup	3			3
Milk	13			13
Cream	19		4	23
Canned soups	32			32
Canned vegetables	65			65
Chili sauce		1		1
Mince meat	9			9
Ground spices in labeled packages	142	28		170
	626	162	30	818
Purchased from importers:				
Pure spices, spice by-products, etc	125			125
Total collected by the station	751	162	30	943

Number of samples of food products found to be pure, etc.—Continued.

Food products.	Unadulterated.	Adulterated.	Contained preservatives.	Total.
Collected by the dairy commissioner:				
Vinegar	20	12	....	32
Molasses	169	34	....	203
Sirups	4	....	....	4
Cream	2	....	....	2
Butter	10	7	....	17
Total collected by dairy commissioner	205	53	....	258
Sent by individuals:				
Milk	96	....	....	96
Cream	9	....	....	9
Total from all sources	1,001	215	30	1,806

Experiments on the metabolism of matter and energy in the human body, W. O. ATWATER and F. G. BENEDICT (*U. S. Dept. Agr., Office of Experiment Stations Bul. 69, p. 112*).—A technical bulletin prepared with the cooperation of A. W. Smith and A. P. Bryant recording the details of 6 experiments with man made with the respiration calorimeter previously described (E. S. R., 9, p. 863; 11, p. 372). Check experiments are also reported in which heat was generated in the respiration chamber by means of an electric current and by the combustion of alcohol. An incidental feature of 2 of the experiments reported was the partial study of the food value of alcohol when used in limited quantities in the daily diet.

Feeding and respiration experiments on the nutritive value of cellulose and certain feeding stuffs rich in cellulose, O. KELLNER (*Chem. Ztg., 23 (1899), No. 79, pp. 828, 829*).—An abstract of a paper describing some of the recent work of the Möckern Experiment Station, presented at the meeting of the Association of German Naturalists and Physicians in Munich in 1899. No experimental data are given in the abstract, which was in effect as follows:

Recently a large number of experiments with ruminants have been made at Möckern on the metabolism of matter and energy. Forty-four were metabolism experiments, each of 14 days' duration, and 184 were respiration experiments each of 24 hours' duration. The author spoke only of those experiments which had to do with the value of cellulose and materials rich in cellulose for producing gains. In measuring this value starch served as a unit of comparison. Thirteen experiments have been made at Möckern with starch. The general method was as follows: In each experiment the ration was so arranged that the subject (a full grown steer) gained a little fat and muscular tissue. The metabolism of matter and energy was estimated in this period and also in a following period in which the basal ration was increased by the addition of single nutrients or some feeding stuff. Deducting the values of the first period from those obtained in the succeeding period gave the figures from which the "productive value," i. e., the value of the nutrient or feeding stuff for producing gains, could be calculated. Suitable corrections were necessary for slight variations in the basal ration and the weight of the animals from day to day. This latter factor needs some explanation. If an animal gains in weight on account of an abundant food supply, the minimum amount of material and energy required for maintenance increases also. This increase is not proportional to the body weight, but to the surface area, which, however, is a function of the body weight. If A and B represent different weights of an animal, the corresponding surface areas would be as $\sqrt[3]{A^2} : \sqrt[3]{B^2}$. Corresponding to this ratio the minimum requirements for increased weight increases more slowly than the surface area.

If the minimum requirement per 1,000 kg. live weight of digestible nutrient in the form of medium meadow hay (6.58 kg.) for a steer weighing 500 kg. is taken as 100, the amount required by a steer weighing 600 kg., 700 kg., and 800 kg. are, respectively, equal to 94.1, 89.5, and 85.6 kg. Since the minimum requirement has been determined at Möckern for 7 individuals up to the present time, this value may be calculated for a steer of any given weight by the above proportion. If the minimum requirement increases while the ratio remains constant, the gain in weight decreases proportionately, and *vice versa.* This point must also be taken into account in comparing the effect of a basal ration plus added material.

The productive value of the following feeding stuffs was determined: (1) Starch (from potato); (2) extracted rye straw (prepared by treating straw with alkali under 7 atmospheres' pressure); (3) medium meadow hay, and (4) well-ripened wheat straw. The extracted rye straw contained 78.7 per cent crude fiber, 20.46 per cent nitrogen-free extract, 0.64 per cent protein, and 0.2 per cent ether extract. The greater part of the incrusting substance was removed. The residue contained, however, 32.9 per cent pentosan. In the experiments with steers the basal ration contained per head per day 2 to 2.5 kg. of starch, 3 kg. of extracted rye straw, 3.5 to 4 kg. of medium quality meadow hay, 4 kg. of oat straw, and 4 kg. of wheat straw. These feeding stuffs did not give up to the body their entire potential energy since there are losses due to the formation of methan and urine. It was found that the isodynamic equivalent of 100 parts of digestible starch was furnished by 103 parts of extracted straw, 108 parts of meadow hay, 100 parts of oat straw, or 113 parts of wheat straw. These are the substituting values for the different materials when they form part of a basal ration. The ratio is different when they form part of a ration for production. When the gain in muscular tissue was reduced to the isodynamic amount of fat and added to the fat gained, it was found that the starch added to the basal ration caused a gain of 217 gms. per kilogram of digestible matter, and extracted straw, 247 gms. That is, the extracted straw, which is very rich in cellulose, was not inferior to starch for producing gain. It must be remembered, in reference to the above statement, that 85.4 per cent of the digestible portion of extracted straw consists of crude fiber. If the latter had been found to possess only a slightly inferior value to starch, the results would have been entirely different. The feeding stuffs rich in crude fiber (meadow hay and unextracted straw) gave very different results, as was to be expected. They induced considerably smaller gains than the extracted straw or than starch. The solid layer of the cells, the material incrusting the cell tissues, the liquified substance of the cells, and the imperfect division of the coarse fodder are very probably the cause of the inferiority of the digestible nutrients contained in such feeding stuffs. In view of the hardness, etc., the coarse fodder must undergo more cleavage due to the agency of micro-organisms and requires a larger amount of energy for the labor of chewing and digesting, which must be deducted from its productive value, than the easily digested starch or the extracted straw, which consists of individual fibers from which the greater part of the incrusting substance is removed. The harder and more compact the feeding stuff, the lower its productive value. Of the coarse fodders experimented with, wheat straw had the least productive value, meadow hay the highest, while oat straw was almost equal to meadow hay. According to the above considerations, it would require, in that portion of a ration used for the production of gain, 374 parts of wheat straw, 57 of oat straw, 153 of meadow hay, or 96 of extracted straw to equal 100 parts of starch, these quantities representing digestible matter in each case. In other words, the values of these feeding stuffs for production are entirely different from their values for maintenance. These experiments emphasize very plainly the rôle of coarse fodder. In rations for maintenance, the value of coarse fodders is determined or limited solely by their content of digestible organic substance. But in a ration for production they should be used only so far as they supply the minimum requirements of the animal. The nutrients which really are utilized for production should not be supplied by coarse fodders, but by those feeding stuffs which are most easily digested. The experiments also show that decreasing the labor of chewing and digesting hard feeding stuffs by suitable methods of preparation is profitable. Such methods of preparation not only increase the palatability, but also increase the productive value of the material.

Contribution to the study of the metabolism of ruminants, O. HAGEMANN and G. ABATI (*Arch. Anat. u. Physiol, Physiol. Abt., 1899, Supt. pt. 1, pp. 111–140*).—The authors' investigations were made with a sheep. Food, urine, and feces were analyzed and their fuel value determined. In addition a large number of experiments were made in which the respiratory quotient was determined. The sheep had a tube inserted in the trachea to facilitate these experiments. The food consisted of maize meal and alfalfa hay. Many determinations were made of the respiratory quotient during chewing, digesting, sleeping, and resting, and the proportion of the day occupied by the different processes was calculated. The principal conclusions follow:

The metabolism of a sheep may be very accurately studied with the aid of calorimetric examinations of the food, urine, and feces, the determination of the carbon in these materials, and the determination of the ratio of oxygen consumed to carbon dioxid excreted. When 350 gms. of maize meal and 600 gms. of alfalfa hay were fed daily, the metabolism of energy of sheep was increased 5.5 per cent over that observed during hunger.

In order to study quantitatively and qualitatively the processes of fermentation which take place in the digestive tract of sheep, a respiration apparatus which permits the measurement and analysis of the total carbon dioxid and other gases produced is essential.

The early feeding of mangels to stock, J. A. VOELCKER (*Jour. Roy. Agr. Soc. England, 3. ser., 10 (1899), pt. 3, pp. 559–566*).—Experiments on the early feeding of mangels to steers and sheep are reported. The principal deductions follow:

"Well-ripened mangels given in moderate quantity, say, 28 to 30 lbs. per head daily, can be quite well fed to fattening bullocks in the early stages, in place of swedes, if along with them be given either common cotton cake, bean meal, or a plentiful supply of long hay. As soon as the quantity of mangels reaches 35 to 40 lbs. per head daily, scouring will probably appear. When this is the case the giving of long hay in quantity will prove to be palliative. Both undecorticated cotton cake and bean meal will soon check the tendency to scour, and . . . bean meal proves the more satisfactory by giving the larger increase in live weight. . . .

"[In the test with sheep] there was, however, no scouring effect whatever produced by the feeding of the mangels, and it would appear, therefore, that mangels can quite well be fed to sheep from the commencement of root feeding, in place of swedes, if about ½ lb. per head daily of undecorticated cotton cake be given along with the food.

"Attention has been directed to the harm that may be caused to male sheep by the feeding of mangels freely, there being a tendency to act on the kidneys, produce increased secretion of urine, and, in extreme cases, the formation of crystals in the urethra. In the above experiment half the sheep were males and half females. The sheep that died on April 6 was a male, and the kidneys were certainly affected, though the bladder was not."

Gorse as a food for sheep, J. A. VOELCKER (*Jour. Roy. Agr. Soc. England, 3. ser., 10 (1899), pt. 3, pp. 567–573*).—The possibility of raising gorse on a poor sandy piece of hillside at the Woburn Experimental Farm, where other crops would not grow successfully, led to experiments with sheep to determine the feeding value of gorse.

"In commencing this experiment it was intended to let gorse replace, as far as it would, the use of roots, seeing that in the event of a failure of roots, or a short root crop, gorse might come in as a very useful substitute, especially in the case of very poor land. A main point of the experiment was, therefore, to see to what extent the replacement of roots by gorse could be effected. The results show very clearly that the replacement could only be made to a limited extent and that at most 2½ lbs. of gorse per head daily would be consumed, taking the place of, say, 6 lbs. of roots. But with this limitation the gorse did exceedingly well as a food and exercised a pronounced benefit upon the sheep, alike as regards their general health, their increase in live weight, and the excellence of the meat produced, so that the use of gorse as an additional food to sheep is decidedly to be recommended."

Whole corn compared with corn meal for fattening hogs, J. H. STEWART and H. ATWOOD (*West Virginia Sta. Bul. 59, pp. 39–46*).—This bulletin contains an account of the pig-feeding experiments at the station in 1897 and 1898.

Whole corn compared with corn meal as a food for fattening hogs (pp. 39–44).—A test to compare whole corn with corn meal was made with 9 pigs divided into lots of 3 each. Lots 1 and 2 were Poland China and Duroc Jersey crosses, and lot 3 Poland China and Berkshire crosses. All the pigs were about 6½ months old at the beginning of the test, which covered 2 periods of 2 weeks each. Lot 1 was fed whole corn and lots 2 and 3 corn meal. Lot 1 consumed during the test 819.3 lbs. of whole corn; lots 2 and 3, 951 and 748.4 lbs. of corn meal, respectively. Lot 1 gained 141.4 lbs., consuming 5.79 lbs. of whole corn per pound of gain; lots 2 and 3 gained 199.9 and 161.4 lbs., consuming, respectively, 4.75 and 4.63 lbs. of corn meal per pound of gain. The authors discuss the tests and summarize the results obtained by other stations on this subject. "The average of these different experiments and our own results indicate that unless a farmer is located very close to a mill or has one upon his own farm, at present prices it will not pay to grind corn for hogs."

Soaking corn for hogs (pp. 44–46).—The comparative value of whole corn soaked in water until soft and corn meal mixed with water was tested with 2 lots of 6 pigs each, of the same crosses as in the preceding test. There were 4 sows and 2 barrows in each lot. The test began October 10, 1898, and closed December 5, being divided into 2 equal periods. Lot 1 was fed soaked whole corn and lot 2 corn meal, each lot being given all they would eat up clean. The 2 lots weighed at the beginning of the test 569.5 and 570.5 lbs., respectively, while the gains made were 555 and 581 lbs. Lot 1 consumed 2,138 lbs. of whole corn, or 3.85 lbs. per pound of gain; lot 2 consumed 2,384 lbs. of corn meal, or 4.1 lbs. per pound of gain. "As very few experiments have ever been performed to determine the effect of soaking grain upon its digestibility, the subject requires further study. The result of our experiment indicates, however, that it is good practice."

Poultry experiments, J. H. STEWART and H. ATWOOD (*West Virginia Sta. Bul. 60, pp. 49–66*).—Tests on the effect of nitrogenous and carbonaceous rations for laying hens, floored vs. unfloored poultry houses, and the effect of age of fowls upon egg production are reported.

A study of the effect of nitrogenous and carbonaceous rations when fed to laying hens (pp. 49–59).—Two tests on this subject are reported. In the first test, made in 1897–98, 6 lots were used with from 10 to 20 fowls in a lot, representing 3 breeds. Lots 1 to 3 were fed the nitrogenous ration, consisting of middlings, linseed meal, ground oats, and corn meal in varying proportions, together with ground fresh meat and bone, while lots 4 to 6 received the carbonaceous ration, of which corn meal was the principal constituent. In addition, all the lots had either boiled potatoes or steamed clover hay, and at night all the whole grain they would eat up clean, consisting of corn, oats, and wheat screenings, corn predominating for the lots fed the carbonaceous ration. The test covered 7 periods of 30 days each.

In discussing the financial side of the test, the feeding stuffs were rated as follows: Small potatoes 20 cts., corn 40 cts., and oats 32 cts. per bushel; hominy feed and corn meal each $14.50 per ton, brown middlings $15, ground oats $20, clover hay $5, and linseed meal $25 per ton; wheat screenings 50 cts. and fresh bone 25 cts. per hundred. During the first 2 months of the test, eggs were valued at 20 cts. per dozen and during the last 5 months at 12 cents. The results are calculated per 100 fowls, and are given in detail. The average results of the test follow:

Nitrogenous vs. carbonaceous rations for fowls, calculated per hundred hens.

	Ration.	Number of eggs laid.	Value of eggs.	Total cost of food.
Lot 1, White Leghorns	Nitrogenous	7,203	$81.39	$32.19
Lot 2, Light Brahmas	do	4,041	41.85	51.42
Lot 3, Rhode Island Reds	do	6,215	71.60	81.03
Lot 4, White Leghorns	Carbonaceous	3,392	40.38	28.48
Lot 5 Light Brahmas	do	2,274	26.28	45.19
Lot 6, Rhode Island Reds	do	4,042	52.40	26.52

According to the authors, the net profits per 100 hens from the lots fed the nitrogenous ration was $97.90, and from the lots fed the carbonaceous ration, $20.59.

The effect of the 2 kinds of rations on the fertility of eggs was tested in incubators. Sixty-six per cent of the eggs produced on the nitrogenous and 47 per cent of those produced on the carbonaceous ration were fertile. The average weight per hundred of the former eggs was 12.68 lbs., and of the latter, 11.57 lbs.

"At the beginning of the experiment, the 3 pens of fowls fed a nitrogenous ration weighed 1,344 lbs. (per 100 fowls), and at the end of the seventh period, 1,698 lbs. They consequently gained in weight 354 lbs., while the fowls fed a carbonaceous ration gained only 34 lbs. . . .

"Although the nitrogenous ration cost slightly more money, yet it was more profitable, because more eggs were laid and the fowls gained more in weight. The eggs from the fowls fed a nitrogenous ration were larger, more fertile, and hatched better and produced far more vigorous chicks than those laid by hens fed the carbonaceous ration. Both lots of fowls remained in a healthy, vigorous condition during the entire test."

The second test was made in 1898–99 with 4 lots of White Leghorn chickens, each containing 10 hens and 1 cock. Lots 1 and 3 were pullets; lots 2 and 4, old fowls. Lots 1 and 2 were fed the nitrogenous and lots 3 and 4 the carbonaceous ration. The test covered 7 periods of 30 days each. All the lots were fed a mash of ground feed in the morning, lots 1 and 2 receiving meat meal in addition during the first

4 periods and ground fresh meat and bone during the remainder of the test. During periods 2, 3, and 4, all the lots were given boiled sugar beets; but, "as the beets seemed to be making the fowls too fat, they were then dropped from the ration, although the fowls were very fond of them." All the lots were fed at night as much grain as they would eat up clean.

The results were calculated per 100 fowls. On this basis, lots 1 and 2 weighed 227 and 304 lbs. at the beginning and 272 and 273 lbs., respectively, at the close of the test; while lots 3 and 4 weighed, respectively, at the beginning 213 and 263 and at the close 250 and 300 lbs.

Calculated per 100 hens, the fowls fed the nitrogenous ration laid 7,555 eggs and those fed the carbonaceous ration 3,431. In the authors' opinion this test is in entire accord with that of the previous year.

Floored vs. unfloored houses for poultry (pp. 50-63).—Two trials are reported. The first included 6 lots of fowls, representing Black Langshan, Brown Leghorn, and Blue Andalusian breeds. Lots 1 to 3 were placed in pens in a portion of the poultry house which was floored with rough boards from 2 to 3 ft. above the ground and the other lots were kept in pens in the unfloored portion. The grain ration fed varied somewhat during the 5 months of the test, but was uniform for all lots.

> "The 3 flocks kept on the floor laid 10,859 eggs (calculated for 100 fowls), while those on the ground laid 13,948. This result was quite contrary to expectations, and can be explained only by the fact that the unfloored pens seemed to be somewhat warmer than the others, as the water in the drinking dishes in the floored pens would sometimes freeze, while in the unfloored pens it seldom did so.
>
> "Quite contrary to expectations, too, the health of the fowls in the unfloored pens remained almost perfect during the entire test. Only 2 fowls died of the roup, 1 from a floored and the other from an unfloored pen, and there was no other sickness of any kind."

A second test of the comparative value of floored and unfloored poultry houses was made in 1898-99 with 2 lots of Rhode Island Red fowls and 2 lots of Light Brahmas. One lot of each breed was kept in unfloored pens and 1 of each in floored pens.

Although the Brahmas did not lay during the test, they began to do so shortly after the test was finished. The health of the fowls seemed good, except in the case of lot 3, where 3 deaths occurred. It was uncertain whether these deaths were caused by the extremely cold weather which prevailed during a few days of the test or by other causes.

> "The result of 2 years' experiments with floored and unfloored houses shows that fowls remain in as healthy condition and lay as many or more eggs when kept in unfloored houses as they do when kept in houses provided with floors. . . . In building poultry houses it probably would be wise to raise the level of the dirt floor by first applying a course of 6 or 8 in. of cracked stone or gravel, and then covering this with a layer of dirt. Such a floor would always be perfectly dry, can be cheaply constructed, and probably would be satisfactory in every way."

The effect of the age of fowls upon egg production (p. 64).—The comparative egg production of pullets and old hens was tested with White and Brown Leghorns, the hens being 3 to 4 years old. The test with the White Leghorns began October 19, 1898, and covered 7 periods of 30 days each. The Brown Leghorns were fed for 4 periods of 30 days. The White Leghorns were the fowls used in the test reported above on the comparative value of nitrogenous and carbonaceous rations. The Brown Leghorns were given practically the same feed as the White Leghorns receiving the nitrogenous ration. The 3 lots of pullets, calculating results per 100 hens, laid during the test 6,209 eggs and the old hens 6,349. The 3 lots of pullets gained 143 lbs., while the old fowls gained 84 lbs.

Description of some Chinese vegetable food materials, W. C. BLASDALE (*U. S. Dept. Agr., Office of Experiment Stations Bul. 68, pp. 48, pls. 8*).—The author reports the composition and discusses the food value, etc., of a number of vegetable food materials in common use by the Chinese on the Pacific Coast of the United States. The bulletin contains many references to the literature of the subject.

Fish as food, C. F. LANGWORTHY (*British Food Jour., 1 (1899), Nos. 10, pp. 292–297; 11, pp. 324–327; 12, pp. 358–361*).—A reprint of Farmers' Bulletin 85 of this Department (E. S. R., 10, p. 678).

Sugar as food, MARY H. ABEL (*British Food Jour., 1 (1899), Nos. 10, pp. 297–298; 11, pp. 328–331; 12, pp. 361–365*).—A reprint of Farmers' Bulletin 93 of this Department (E. S. R., 11, p. 278).

Two forms of apparatus for regulating and measuring the work performed by man, N. ZUNST (*Arch. Anat. u. Physiol., Physiol. Abt., 1899, No. 3–4, pp. 372–375, fig. 1*).—The author describes two forms of apparatus for regulating and measuring work performed by man. Such apparatus is called a bremsergometer.

Food—nutrients—food economy (*U. S. Dept. Agr., Office of Experiment Stations Circ. 43, p. 6*).—Summarizes briefly a number of the general principles of food and nutrition.

Analyses of feeds, A. L. WINTON, A. W. OGDEN, and W. L. MITCHELL (*Connecticut State Sta. Rpt. 1898, pp. 308, 309*).—The composition of Blatchford's calf meal, Chicago gluten feed, H. O. dairy feed, Quaker oat feed, and chaff is reported. A brief note is given of the examination of 2 samples of wheat flour. One was found to consist wholly of wheat; the other contained a large quantity of cornstarch. The value of commercial mixed feed is discussed.

Concentrated feed stuffs, J. B. LINDSEY (*Proc. Soc. Prom. Agr. Sci., 1898, pp. 77–86*).—The more important concentrated feeding stuffs are described, the laws regulating the sale of feeding stuffs in various countries and States are quoted, as well as the experiences of the first year in Massachusetts under the State law on this subject.

Fodders and feeds, L. A. VOORHEES and J. P. STREET (*New Jersey Stas. Rpt. 1898, pp. 101–121*).—Analyses are reported of rye and crimson clover, imported crimson clover, Japan broom-corn millet, Japan millet, soy beans, green soy beans, barley and peas, cowpeas, corn fodder, oats and peas, Canada field peas, corn, corn stover, shelled corn, corncobs, waste corn fodder, cornstalks, corn silage, mixed hay, rice meal, oats, wheat bran, dried brewers' grains, undigested corn, cotton-seed meal, undecorticated cotton-seed meal, old process linseed meal, Cleveland flax meal, gluten meal and feed, and prepared feeds (Quaker oat feed, H. O. dairy feed, H. O. horse feed, and Blatchford's calf meal). Many of these analyses were made in connection with experiments conducted at the station.

Among other topics, a discussion of the composition, adulteration, and inspection of feeding stuffs is reprinted from Bulletin 131 of the station (E. S. R., 10, p. 977), as well as the market price of a number of commercial feeds. The article also includes a compilation of average analyses of the more important fodders and feeding stuffs.

The value of molasses as a food for farm animals (*Landtm. Månadsbil., 1899, No. 7, pp. 97-101*).

Concerning the phosphorus of muscular tissue, J. J. R. MACLEOD (*Ztschr. Physiol. Chem.. 28 (1899), No. 5-6, pp. 535-558*).—From a number of experiments the author draws the following conclusions: The amount of phosphorus of organic compounds in the aqueous extract of muscular tissue is much diminished by muscular work, while the amount of phosphorus of inorganic compounds is correspondingly increased. Intense muscular exertion diminishes the nucleon-phosphorus in the aqueous extract of muscular tissue, and there is an especially noticeable decrease of the organic compounds containing phosphorus which are not contained in the nucleon.

Influence of large quantities of water upon the excretion of nitrogen by man, R. O. NEUMANN (*Arch. Hyg., 36 (1899), No. 3, pp. 248-263, table 1*).—A number of experiments are reported which, in the author's opinion, show that the consumption of large quantities of water did not cause a permanent increase in the amount of nitrogen excreted and that, accordingly, it is proper to assume that there was no increase cleavage of protein.

The influence of nutrients in restoring exhausted muscle, J. FRENTZEL (*Arch. Anat. u. Physiol., Physiol. Abt., 1899, No. 3-4, pp. 383-388*).—Experiments with two men were made in which a Mosso ergograph was used. The author concludes that protein restores exhausted muscle in about the same time as sugar and that the restoring value of protein is quantitatively larger than that of sugar. Experiments on the value of fat for restoring exhausted muscle are also briefly noted, as well as a number of observations on the time which elapses before nitrogen consumed is recovered in the urine.

Note on the metabolism of ruminants, O. HAGEMANN (*Arch. Anat. u. Physiol., Physiol. Abt., 1899, Sup. pt. 2, p. 382*).—This is a note regarding some of the calculations in the article abstracted above (p. 772).

The fate of proteid materials when introduced into the circulatory system, I. MUNK and M. LEWADOWSKY (*Arch. Anat. u. Physiol., Physiol. Abt., 1899, Supt. pt. 1, pp. 73-88*).—A number of experiments are reported.

Metabolism experiments with edestin, R. LEIPZIGER (*Arch. Physiol. [Pflüger], 78 (1899), No. 7-8, pp. 402-422*):—A number of experiments with dogs are reported. The edestin used was prepared from hemp seed according to Osborne's method. The balance of income and outgo of nitrogen, phosphoric acid, calcium, and magnesium was determined.

Amylaceous digestion in the stomach of carnivora, H. FRIEDENTHAL (*Arch. Anat. u. Physiol., Physiol. Abt., 1899, Sup. pt. 2, pp. 383-390*).—According to the author, his experiments show that soluble starch, ethero dextrin, and very small quantities of maltose are formed by the diastatic ferment, but carbohydrates undergo no other change in the stomach of dogs.

The excretion of borax, E. ROST (*Arch. Anat. u. Physiol., Physiol. Abt., 1899, Sup. pt. 2, pp. 568-570*).—From experiments which are briefly described, the conclusion is drawn that rabbits excrete borax from the mucous membrane of the digestive tract when it has been introduced intravenously and subcutaneously. The article contains a number of references to similar investigations.

The influence of thein upon the excretion of alkalis in urine, I, K. KATSUYAMA, T. KUWAHARA, and K. SENO (*Ztschr. Physiol. Chem., 28 (1899), No. 5-6, pp. 587-594*).—From a number of experiments with rabbits, the authors conclude that, together with an increased excretion of urea, thein induces an increased excretion of the alkali of the urine.

Annual reports of the live stock associations of the Province of Ontario, 1898-99 (*Toronto: Ontario Dept. Agr., 1899, pp. 169*).—This contains the usual statistics and reports.

An investigation of the (Privislyansk) Russian Polish horned cattle, N. LOUCHNIK (*Selsk. Khoz. i Lyesov., 194 (1899), Sept., pp. 401-443*).—The author points out that the cattle raised in Russian Poland are of inferior breed and discusses the reasons for this.

Sheep-fattening experiments, 1898–99, J. GRUDE (*Aarsber. Offent. Foranst. Landbr. Fremme, 1898, pp. 292–304*).

Purchased feeding stuffs consumed [by sheep pastured] on grass (*Rpt. Agr. Expts., Cornwall, County Council, 1898, p. 49*).—A brief note on experiments on the value of different feeding stuffs for supplementing pasturage. Four plats were used; 18 sheep were fed on each plat 31 days and 8 sheep 52 days. Linseed cake was fed on plat 1, decorticated cotton-seed cake on plat 2, and maize on plat 3. The sheep on plat 4 consumed no grain in addition to pasturage.

"With the experience of 2 seasons only to guide us it would be decidedly premature to express a definite opinion on the respective manurial residues of these feeding stuffs. Nevertheless it is a curious fact that among landowners and farmers of experience who have inspected the plats there is complete unanimity of opinion as to the results. The plat upon which linseed cake is consumed is very closely grazed and is given the first place. Between maize and cotton cake the difference is very trifling, but the difference between the plat upon which no feeding stuffs are consumed and the 3 foregoing is becoming marked."

The Anglo-Norman horse, A. GALLIER (*Le cheval Anglo-Normand. Paris: J. B. Baillière & Sons, 1900, pp. 320, ill.*).—The origin, history, and value of the Anglo-Norman horse is discussed, as well as the value of this breed and methods of encouraging the breeding of these horses.

Native Russian races of horses, S. P. URUSOV (*St. Petersburg: Min. Agr. and Imp. Domains, 1899, pp. 111; rev. in Selsk. Khoz. i Lyesov., 195 (1899), July, pp. 181, 182*).—A report to the Imperial Department of Agriculture.

A portable poultry house (*Queensland Agr. Jour., 5 (1899), No. 6, pp. 562, 563, pl. 1*).—A poultry house suitable for housing poultry in a large run in stubble fields is described.

DAIRY FARMING—DAIRYING.

Some of the factors determining the richness of milk, C. D. SMITH (*Proc. Soc. Prom. Agr. Sci., 1898, pp. 152–155*).—Records of a herd of some 25 cows at the Michigan Station for 5 years and of 8 cows at the New York State Station are summarized and used in a discussion of variations in the composition of milk during successive periods of lactation, from month to month in the same period, during different seasons of the year, and from day to day. The following conclusions are reached:

"(1) A cow yields as rich milk as a heifer as she will as a mature cow. . . .

"(2) The milk is as rich in the first month of the period of lactation as it will be later, except perhaps during the last few weeks of the milk flow, when the cow is rapidly drying off.

"(3) There is little difference in seasons as to the quality of the milk. Milk, while the cows are at pasture, is neither richer nor poorer, on the average, than the milk yielded when the cows are on winter feed.

"(4) The milk of a fair-sized dairy herd varies little in composition from day to day. Radical variations in this respect should be viewed with suspicion, as indicating either mistakes in testing or gross mismanagement of the herd."

Can the brain and nervous system of a cow affect her yield of butter fat? J. H. SHEPPERD (*Proc. Soc. Prom. Agr. Sci., 1898, pp. 185–193*).—In a discussion of this subject the author reports 2 experiments conducted by himself, and reviews a number of experiments made at various stations relative to the effect of change of milkers, change of quarters, and frequent milking.

In the first experiment by the author a comparison was made of the amount of milk drawn from a cow by a man and a calf, both beginning at the same time, and each milking two teats. The difference in the weight of the calf before and after milking was taken as the quantity of milk drawn by the calf. The experiment lasted 6 days, during which the calf obtained 2.8 lbs. more milk than the man under the same conditions. The second experiment was a comparison of 3 milkers. The trial lasted 4 weeks and included 3 cows. The change in milkers was made every 2 or 3 days. Considerable differences were observed in the yields of milk and fat obtained by the different men.

Theories accounting for the results obtained in the author's experiments and for the effects due to change of milkers, change of quarters, and frequent milking in the cases cited are presented. The data are considered as satisfactorily explained on the theory that the brain and nervous system of the cow can affect the yield and composition of her milk.

Comparison of mixed grain and Indian corn for dairy cows, F. FRIIS ET AL. (*15. Rpt. K. Vet. Landbohöjskoles Lab. Landökon Forsög* [*Copenhagen*], *1899, pp. 171*).—The report gives a full account of the eleventh and twelfth years' cooperative feeding experiments conducted under the direction of the State Danish Experiment Station. In both these years Indian corn was compared with barley and oats, the common grain feeds for milch cows in Denmark. The experiments were conducted according to the same general plan as earlier ones (E. S. R., 9, p. 983). Seven estates took part in the work in both years, and furnished 264 cows in 1898 and 241 in 1899 for the experiments. The rations of the cows were the regular rations of the estates during the preparatory and post-experimental periods, the grain fed in all cases consisting of one-half barley and oats and one-half corn. During the experimental period proper lot A received barley and oats only, while lot C received corn only, and lot B received the mixture of barley, oats, and corn. The corn and mixed grain were fed against each other, pound for pound. In addition to these materials all the lots received the same amount of oil cakes, mangels, and hay, and straw *ad libitum*. The quantities of corn and mixed grain that replaced each other varied on the different estates from 1½ to 3 lbs. (Danish) daily per cow, and this constituted from one-half to two-thirds of the total concentrated feed. The results obtained as regards the fat content of the milk showed only insignificant differences, on the average, for all herds.

The small differences were in favor of the mixed grain, but too small to have any practical importance, being within 0.1 per cent. The same was true of the results of the complete chemical analyses.

As regards the quantities of milk yielded by the different lots, the corn-fed lots produced, on the average, slightly more milk. There was a small gain in milk of lot C (corn only) over the average yields of either lot A (mixed grain only) or lot B (mixed grain and corn, half and half). The production of butter fat was, however, almost identical for the different lots, with a tendency toward lower results for corn (average daily yields per head: 0.724, 0.723, and 0.722 lb. for lots A, B, and C, respectively).

The weighings made of the cows at the different periods of the experiment showed that the corn-fed cows increased slightly more in live weight than either of the two other lots, the increase per head per day for the 3 lots being 0.21, 0.25, and 0.33 lb., respectively. The consumption of straw was not influenced by the kind of grain fed.

Influence of corn on quality of butter.—The keeping quality of the butter produced on two of the estates participating in the experiments was ascertained by the method adopted in the scoring of butter at the Permanent Danish Butter Exhibitions, the butter being scored twice, a few days after it was made and again 14 days later. The butter produced by the corn-fed cows scored somewhat higher and kept slightly better than that from the two other lots. The analyses of the butter fat showed that the iodin number and the refractive index were increased to some extent by the corn feeding, and the volatile fatty acids were changed in a similar manner as when oil cakes were fed (E. S. R., 9, p. 490). The churning temperature of the cream from the corn-fed cows lay somewhat lower (0. 7 to 1.1° F.) than that from the other lots, with other churning factors the same.

Influence of sugar-beet pulp on quality of butter.—The effect of sugar-beet pulp on the quality of the butter produced was studied in an experiment at Egeskov estate during 1898–99 with 30 cows, separated into 3 lots. Lot A received 25.4 lbs. of mangels, lot B 30.5 lbs. of beet pulp, and lot C 61.0 lbs. of pulp, the feed being otherwise similar for all lots, with the exception that the allowance of mixed grain for lot C was reduced by 2.5 lbs. on account of the heavier pulp feeding.

The first scoring of the butter showed that produced by lot B to be of slightly better and that produced by lot C of slightly lower quality than the butter from lot A (mangels), while the second scorings showed that the keeping quality of the butter from all lots was similar. The churning time was 4½ minutes longer, on the average, for lot C than for lot A, and the end temperature of the churning 0. 7° F. higher than that for lot A, with other factors similar. The determinations of iodin number and refractive index failed to show any difference between the butter produced by the different lots, while the pulp-feeding evidently decreased the volatile fatty acids by 1 to 2 cc. (lot A, 33.9; lot B, 32.6; lot C, 32.0 cc.).—F. W. WOLL.

The influence of pasturage on the fat content of milk, K. P. KJÄRSGAARD (*Mälkeritid., 12 (1899), No. 18, pp. 319–321*).—The fat content of the milk of 19 different Danish herds of dairy cattle was determined before and after the cows were turned to pasture in the spring. The first series of determinations was made between April 25 and May

19, the second 20 days later, and the third 40 days after the latter. The size of the herds ranged from 4 to 99 cows, the average being about 33 cows. The average results obtained for all herds are shown below:

Fat content of milk before and after turning cows to pasture.

	Average.	Range.
	Per cent.	*Per cent.*
On winter feed	3.33	3.09–3.56
On pasturage, first test	3.67	3.23–4.04
On pasturage, second test	3.60	3.34–3.97

The first set of determinations gave higher results on pasture in case of 10 herds, and the second set in case of 7 herds, while 1 herd showed the same fat content on winter feed and first time on pasturage, and 1 herd showed the same fat content both times on pasturage. In no case was a higher fat content found when the cows were on winter feed than when at pasturage.—F. W. WOLL.

On the effect of pasture on the yield and quality of milk, F. FRIIS (*45. Rpt. K. Vet. Landbohöjskoles Lab. Landökon Forsög* [*Copenhagen*], *1899, pp. 57–65, 88–93*).—The cow-feeding experiments conducted by the Danish State Experiment Station during the past 10 years have always been continued until after the cows were let out to pasture in the spring. Experiments of this kind have been conducted on 8 different estates, 4 to 8 each year, and included 1,961 cows in all. The results have been compiled by the station and are presented in full in the report. The milk yield and percentages of fat and total solids have been calculated for each estate and for each year for 3 ten-day periods immediately preceding and following the tying out at pasture. The average results obtained for all cows included in the experiments are shown in the following table:

Effect of pasture feeding on milk yield.

Year.	Number of estates.	Yield of milk per cow daily.						Fat content of milk.					
		Winter feeding.			Pasture feeding.			Winter feeding.			Pasture feeding.		
		Period 3.	Period 2.	Period 1.	Period 1.	Period 2.	Period 3.	Period 3.	Period 2.	Period 1.	Period 1.	Period 2.	Period 3.
		Lbs.	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
1890	6	21.4	20.6	19.9	21.8	22.5	21.3	3.26	3.31	3.37	3.63	3.41	3.33
1891	4	20.7	20.0	19.2	19.3	21.8	20.8	3.29	3.32	3.38	3.55	3.32	3.28
1892	7	21.0	20.4	19.7	19.7	21.0	20.4	3.15	3.17	3.21	3.45	3.31	3.26
1893	8	20.4	19.9	19.4	20.8	19.8	18.4	3.17	3.20	3.23	3.43	3.30	3.28
1894	8	21.5	20.9	20.8	22.4	22.4	20.5	3.06	3.12	3.13	3.40	3.35	3.36
1895	5	21.0	20.9	20.4	23.0	22.0	20.0	3.16	3.20	3.18	3.41	3.30	3.26
1896	5	21.4	21.2	21.2	23.2	22.4	20.6	3.15	3.15	3.20	3.48	3.41	3.28
1897	5	21.5	21.3	21.0	23.2	21.8	20.1	3.13	3.15	3.16	3.43	3.32	3.30
1898	4	22.0	22.0	21.3	23.4	23.2	21.6	3.12	3.13	3.19	3.54	3.39	3.41
1899	5	21.2	20.7	19.9	21.6	21.7	20.5	3.07	3.05	3.11	3.42	3.32	3.23
Average	....	21.2	20.7	20.2	21.7	21.7	20.3	3.15	3.18	3.21	3.47	3.34	3.30

The highest yields of milk after the cows were let out in some years came during period 1 and in others during period 2; the weather may have been the deciding factor in bringing about this result. The average for all years and series of experiments was 21.7 lbs. for both periods.

The composition of the milk, calculated as shown in the preceding table, was as follows:

Average composition of milk on winter feeding and pasturage.

	Winter feeding.			Pasture feeding.		
	Period 3.	Period 2.	Period 1.	Period 1.	Period 2.	Period 3.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Total solids	11.87	11.91	11.95	12.37	12.27	12.23
Solids-not-fat	8.72	8.73	8.74	8.90	8.93	8.93

While the fat content of the milk after 30 days on pasturage had gone down to where it would have been if the cows had been in the stable and the percentage of fat had continued to increase in the same ratio as during the last 30 days of stable feeding, the total solids content was not decreased to a similar extent. The results of the complete chemical analyses of the milk during one year indicate that this is due to an increase in the percentage of nitrogenous components in the milk, since both the milk sugar and ash remained nearly uniform before and after the cows were let out.

It should be observed that all animals included in these experiments were fall-calving cows; the results obtained do not, therefore, necessarily apply to spring-calving cows, or to cows that are farther removed from the drying-off stage than these cows were during the last ten-day period on pasturage.—F. W. WOLL.

Dairy husbandry, C. B. LANE (*New Jersey Stas. Rpt. 1898, pp. 205-226*).—Conclusions from three years' work upon the cost, yield, and feeding value of various forage crops are reprinted from Bulletin 130 of the station (E. S. R., 10, p. 946); and an account is given of dairy work during the year, including the growing of various soiling crops, a study of the character of the refuse from the feeding of cornstalks, experiments upon the relative feeding value of whole and ground corn, data on the cost of milk production, and a record of the dairy herd.

A large number of soiling crops were grown in different rotations on acre plats. These furnished green fodder for 25 cows from May 1 to October 5. Tables show the cost of production, yield, arrangement, and the amount of nutrients furnished by each crop. Brief notes are given on the growth of the different crops. Eight tons of green forage was secured from 2 cuttings of alfalfa. Further experiments are considered necessary to determine the value of vetch as a soiling crop. Spring rye grown with peas showed no advantage over oats.

Determinations were made of the amount and composition of the portion of cornstalks remaining uneaten when fed to stock. During an experiment lasting 10 days one cow was fed 200 lbs. cornstalks, of which 60 lbs. remained uneaten. Analyses of the cornstalks and refuse and the digestible nutrients in the portions fed, wasted, and eaten in the experiment are given. From the data obtained the author computes a balanced ration made up of 20 lbs. cornstalks and 3 lbs. each of wheat bran, dried brewers' grains, corn meal, and linseed meal.

"The results of this experiment show very strongly the advantage in using a silo. At least $\frac{5}{6}$ of the 30 per cent waste in feeding dry cornstalks, as indicated in the experiment, could be prevented by using a well-built silo; besides, 12 per cent more milk could be produced from the silage than from the dried stalks."

Whole corn and corn-and-cob meal, in rations otherwise alike, were fed to 2 cows, one in the fifth and one in the tenth month of lactation. The test covered 2 periods of 12 days each, with a preliminary period of 5 days and a transition period of 5 days, when the rations were reversed. The yield of milk was 9.3 per cent greater and the yield of fat 4.9 per cent greater from the meal ration. There was also a slight increase in the weight of the animals when fed the meal ration. The results are attributed to the greater digestibility of corn-and-cob meal as compared with whole corn. It is estimated that the feeding value of a ton of corn is $2 greater when fed in the form of meal than when fed whole, deduction being made for the additional cost of husking and grinding. Determinations showed that 57.3 per cent of the corn fed on the ear passed through the alimentary tract undigested.

The cost of milk production for the year ended April 1, 1898, is given. The herd averaged 25 cows for the year.

"The average cost of the daily ration was 11.44 cts. of which 5.06 is due to purchased feeds and 6.38, or 56 per cent, to the cost of farm foods. The cost of food per quart of milk is shown to be 1.47 cts. of which 0.65 ct. is due to purchased feeds and 0.82 ct. to farm crops. . . .

"The cost per hundred [including the cost of labor and the interest on and decrease in the value of the herd] was $1.10. At $1 per hundred, the price received in rural districts, the profits from the business, if any, must be in the manure. In the calculation of the cost of farm foods, the manure was charged at the rate of $1.50 per ton, and the amount produced by the herd during the year was 274 tons.

"In selling milk for $1 per hundred, the receipts are $154.77 less than the expenses. Deducting this amount from the actual charges made for the manure in the growing of the crop, $1.50 per ton, there remains $256.23, which represents the profits from 25 cows—an amount too small to make the business pay.

"At 3 cts. per quart, the price that could have been received at wholesale, the receipts would amount to $2,129.70; deducting the cost of purchased feeds, hay and interest and decrease in value of herd, amounting to $1,187.12, we have a balance of $942.58, which represents the value of the home-grown produce, or, in other words, at 3 cts. per quart, the farm would sell its home-grown produce to the dairy at profitable prices, viz, $2.50 for soiling crops, $5.05 for silage, and $8 per ton for dried corn stover, a gain on the crops over cost of production of $1.10 per ton for soiling crops, $2.60 for silage, and $3 for dried corn stover, besides an additional gain represented by the 274 tons of manure."

A table shows the amount of fertilizing elements contained in the feeding stuffs purchased and in the milk produced by the herd of 23 cows in 1896 and 25 cows in 1897. During the two years the excess of nitrogen, phosphoric acid, and potash in the feeding stuffs purchased over the quantities in the milk sold from the farm was 1,705, 1,401, and 505 lbs., respectively.

The record of 26 cows remaining in the herd throughout one year, ended April 1, 1898, is given.

Records of best and poorest cows for milk and butter production.

	Animal yield.	Value of product.			Cost of feed.	Gain over cost of feed with—		
		Milk at 1 ct. per lb.	Milk at 3 cts. per qt.	Butter at 20 cts. per lb.		Milk at 1 ct. per lb.	Milk at 8 cts. per qt.	Butter at 20 cts. per lb.
Milk production:	*Pounds.*							
Best cow	9,148	$91.48	$125.88		$41.76	$49.72	$84.12	
Poorest cow	4,189	41.89	57.65		41.76	.13	15.89	
Average cow	6,143	61.43	84.54		41.76	19.67	42.78	
Butter production: *a*								
Best cow	442			$88.40	41.76			$46.64
Poorest cow	238			47.60	41.76			5.84
Average cow	318			63.60	41.76			21.84

a Calculated.

"The tabulation shows that the best cow pays for her feed and $46.64, in addition to skim milk and manure to represent the care and profits, while the manure and skim milk of the poorest cow, in addition to $5.84, represent the pay received for her care and the labor of making the butter. The facts brought out by the above records indicate that there is but little profit derived from a cow that does not produce 200 lbs. per year, and points to the necessity of careful selection of animals for the butter dairy."

The average waste per month during the year from handling, cooling, bottling, and delivering the milk was 9.3 per cent.

The white blood corpuscles in milk and Storch's test for pasteurized milk, C. BARTHEL (*Nord. Mejeri-Tidn.*, *14* (*1899*), *No. 16*, *p. 215*).—The author states that cows' milk contains normally large numbers of leucocytes, and attributes the reaction obtained in dairy products with peroxid of hydrogen (E. S. R., 10, p. 384) to their presence. Leucocytes appear in the greatest abundance in separator slime and can be readily observed there under the microscope by staining with hæmatoxylin, which will show numerous nuclei of the leucocytes. It is also possible, the author says, that some of the cell nuclei thus observed are derived from torn epithelial cells of the alveoli of the milk glands. Cream is richer in leucocytes than skim milk, which in the author's opinion is due to the adhesion of leucocytes to the fat globules by which they are carried over into the cream.

The author considers the leucocytes, or an enzym secreted by them, the cause of the phenomena observed by Babcock and Russell and by them attributed to a special unorganized ferment called galactase. Aside from the similarity in the behavior toward Storch's test, the leucocytes are said to behave toward anæsthetics in the same manner as galactase. Formalin, carbolic acid, and corrosive sublimate destroy their action, while chloroform, ether, and benzol are stated to have no influence in this direction. Another indication that the color reaction obtained in Storch's test is due to the presence of leucocytes is that whey gives a reddish brown, and not a blue color, as in case of milk. The latter color has been shown by Storch to be due to the casein of the milk. Blood serum treated with paraphenylendiamin and peroxid of hydrogen will also give a reddish-brown color.

The property to decompose H_2O_2 is, however, one common to all protoplasmic substances, and not to fibrin or enzyms alone, provided it has not been destroyed by heat or special reagents. If leucocytes obtained from blood that has been entirely freed from plasma by washing with ice-water, are added to milk previously heated above 80° C., the blue color will appear in the peroxid test; the same test will, however, be obtained if blood serum prepared by filtering through a Chamberland filter is added to heated milk.—F. W. WOLL.

The preparation of cream and butter free from injurious microorganisms, K. B. LEHMANN (*Arch. Hyg., 34 (1899), No. 4, pp. 261–271*).—In 6 experiments the cream separated by a hand separator was found to contain approximately twice as many germs in 1 cc. as the milk from which it was derived. The process of butter making, it is said, does not destroy these germs. The dangers from these sources are pointed out. Experiments in pasteurizing the fresh cream by heating for 10 minutes at 80° C. were unsuccessful, but this is attributed to the apparatus. With the use of a simple stirring apparatus the pasteurization for 10 minutes at 85° was found sufficient, reducing the germ content to about 0.1 per cent of the original.

The control of a commercial cream-pasteurizing plant for about 8 months showed that heating for 10 minutes at 85° C. reduced the germs from about 10,000,000 to 7,000 per cubic centimeter except in the very hot weather. The author considers that the hygienic requirements were practically fulfilled. The cream had an agreeable cooked taste, similar to burnt almonds, kept 48 hours except in hot weather, and was readily churned, either sweet or sour.

Bacillus typhi abdominalis in milk and butter, H. L. BOLLEY and M. FIELD (*Proc. Soc. Prom. Agr. Sci., 1898, pp. 168–175*).—The biological characters of the typhoid bacillus and the sources of milk contamination with this germ are discussed, and investigations to determine the persistence of typhoid germs in milk and its products are reported.

During 1897 and 1898, 248 separate experiments in inoculating dairy products with typhoid germs were made. A table gives the data for 23 of these experiments considered as giving results of undoubted accuracy. A sample of butter salted at the rate of 1 oz. to the pound and another sample salted at the rate of 4 oz. to the pound were inoculated with typhoid germs in small pits in the butter where the buttermilk had collected. The germs multiplied but did not spread into the surrounding butter. Cultures made at the end of 7 days from butter at the margin of one of these pits proved fatal to guinea pigs when inoculated into the body cavity. In only 1 out of 8 experiments reported did typhoid germs survive for a longer period than 10 days in butter which had been thoroughly infected. No marked growth of the germs was observed in samples from which the buttermilk had been thoroughly worked out. Typhoid germs remained alive for several months in cream and in the buttermilk and unsalted butter from the infected cream. In experiments with sweet milk the results are considered as adding nothing to previous work. The germs developed in great numbers and the milk became acid but did not coagulate. In mixed infection the typhoid germs were not outgrown and in some cases became predominant.

The part played by lactic-acid bacteria in the ripening of cheese, E. VON FREUDENREICH (*Centbl. Bakt. u. Par., 2. Abt., 5 (1899), No. 8, pp. 240–249*); and H. WEIGMANN (*Centbl. Bakt. u. Par., 2. Abt., 5 (1899), No. 18–19, pp. 630–641*).—The first paper is largely a controversial article in which the various theories of the cause of the ripening of cheese are reviewed, and especially the views of Weigmann expressed in a previous article (E. S. R., 10, p. 592) are combated. An additional series of experiments is given with milk inoculated with a number of forms of lactic-acid bacteria, chalk being added to neutralize the acid produced. With some forms a considerable decomposition of the casein was indicated by the analysis. One of the most active forms had previously been found in a number of samples of natural rennet.

The author explains that he has worked only with hard cheese, while Weigmann used soft cheese. He fails to find any anaerobic bacteria in Emmenthaler cheese. He has verified Babcock and Russell's discovery of an unorganized ferment in milk and believes that it may play a part in the ripening of cheese. He suggests that the ferment may prepare the casein for the action of the lactic-acid bacteria by dissolving it.

In the second paper Weigmann gives some additional experiments which he holds show that lactic-acid bacteria do not play the principal part in ripening, even in hard cheese (Tilsiter), as a number of other forms were found.

In further experiments the effects of lactic-acid bacteria, *Clostridium licheniforme*, *Paraplectrum fœtidum*, *Oïdium lactis*, *Penicillium*, and *Mucor mucedo* were studied. After preliminary trials these were used in different combinations in milk cultures. It was found that both of the molds have a very powerful peptonizing action and that Johan-Olsen was right in including them in the list of cheese-ripening organisms. They also give a flavor to the cheese.

The author believes that all of the bacteria found in milk work together, partly simbiotically and partly metabiotically, the lactic-acid bacteria first preparing the material for the growth of the others, the molds and the various coli bacteria taking care of the lactic acid formed and at the same time peptonizing the casein and producing flavors, and the bacteria of the class of Paraplectrum and Clostridium giving the cheese the characteristic odor and taste. The character of the cheese will depend upon the proportion in which these organisms are present, which in turn will depend upon the method of making.

Practical experiments in making Tilsiter cheese are then reported, in which mixtures of the organisms mentioned above were used, the proportions being given as nearly as practicable. The results show that the ripening was best when the whole category of organisms was present.

The author questions whether, when all of the cheese-ripening organisms have been discovered and the relative proportions for different kinds of cheese worked out, it will be possible to entirely exclude the action of the organisms remaining in the milk (even after pasteurization) or gaining access during the process of cheese making. He suggests that the effect of the milk and the place of manufacture will still be apparent, and points out that the matter is not as simple as in the case of cream ripening, which occupies only a short time.

A study of the bacterial flora of Roquefort cheese, GRIMM (*Selsk. Khoz. i Lyesov., 194 (1899), July, p. 27*).—A preliminary account of this investigation, which is not yet completed. The following results have been obtained: The green particles which permeate the ripe cheese are aggregates of spores of *Penicillium glaucum*, which thus appears to be a specific constituent of this cheese and which imparts to it its peculiar taste. The poisonousness of *Penicillium glaucum* explains why the extensive use of this cheese as food is injurious. Further, a new lactic-acid bacillus has been separated which is not identical with the lactic-acid bacilli of Heuppe, Leichmann, and Weigmann. The transformation of milk sugar into acid under the influence of this bacillus takes place more rapidly than under the influence of *Bacillus acidi lactici*.—P. FIREMAN.

Annual reports of the cheese and butter associations of the Province of Ontario, 1898 (*Toronto: Ontario Dept. Agr., 1899, pp. 192, figs. 5*).—This contains the proceedings of the annual meetings of the associations, including a large number of popular articles, and an appendix giving a list of members and officers of the associations and a financial statement.

Report of the dairy institute at Proskau for 1898–99 (*Bericht über die Thätigkeit des Milchwirthschaftlichen Instituts zu Proskau für das Jahr vom 1. April 1898 bis 1. April 1899. Oppeln: Joseph Wolff, 1899, pp. 25; abs. in Milch Ztg., 28 (1899), No. 38, pp. 598, 599*).—A general report on educational and experimental work and on the production of butter and cheese at the institute.

Report of the State dairy agent in Manchester, England, for 1898, H. WEDIN (*Meddel. K. Landtbr. Styr., 1899, No. 52, pp. 75*).

Recent progress in dairying, P. DE VUYST and P. WAUTERS (*Nouveaux progrès en laiterie. Louvain: A. Uystpruyst, 1899, pp. 81, figs. 49*).—Contains a general review of recent inventions in dairy apparatus and of investigations along different lines of dairy work, an account of cooperative dairying and dairy associations in different countries, and of instruction in dairying in Belgium, and a list of some of the more recent dairy publications.

The Ayrshire cow, J. STEWART (*Queensland Agr. Jour., 5 (1899), No. 6, pp. 546–548*).—A brief discussion of the origin of Ayrshire cattle, with notes on their care, management, etc.

Is the weight of cows of influence on the profitableness of dairying? (*Molk. Ztg., 13 (1899), No. 35, p. 545*).—Cows weighing between 1,000 and 1,300 lbs. are considered in general the most profitable.

The truth regarding the spaying of milch cows, ELOIRE (*Progrès Vét., 1898; abs. in Deut. Thierärztl. Wchnschr., 7 (1899), No. 15, p. 141*).—All of the cows of a large and well managed dairy failed to get with calf during an entire year, owing to the impotency of the bull; but notwithstanding this, the cows continued to give milk for nearly 2 years in the same manner as if they had been spayed. Had these cows been spayed after calving the prolonged lactation, the author says, would have been credited to the operation. He admits that spayed cows tend to get fat, provided the lactation is not prolonged.

How can a large yield of milk of good quality be secured? A. STUTZER (*Wie erhalten wir viel Milch von guter Beschaffenheit? Leipsic: Hugo Voigt, 1899, pp. 122*).—This is a second edition of this popular pamphlet on the principles of feeding milch cows, the effect of food on yield and composition of milk, and the personal equation of the cow herself. The author concludes that the latter is a factor of great importance.

The production of milk and butter in Denmark, B. BOGGILD (*Ugeskr. Landm., 44 (1899), No. 47, pp. 585–587*).—The number of creameries in Denmark in 1897 was 1,145, which produced a total of 127.7 million lbs. of butter and 20.96 million lbs. of skim-milk cheese. The average price received at the factory for the products were: butter, 21.5 cts. per pound; cheese, 3.5 cts. per pound. Assuming that the above quantity of butter represents nine-tenths of the butter production of the country, the total production was 141.93 million lbs., or about 133 lbs. of butter per cow. The per capita consumption of butter (and oleomargarine) is calculated to approximate 30 lbs., or at the highest estimate 33 lbs. The production of milk is estimated at 4,958.6 million lbs., or about 4,620 lbs. per cow and 2,200 lbs. per capita.—F. W. WOLL.

Accounts of 27 cooperative creameries in Holbäk Amt, Denmark, S. MADSEN (*Mälkeritid., 12 (1899), No. 27, pp. 455–467*).—The article gives detailed information concerning the different phases of the business of 27 Danish cooperative creameries, number of patrons and cows, equipment, milk and butter account, losses, fat content of skim milk, expense account, total and per 1,000 lbs. of milk received, gross and net receipts, etc.—F. W. WOLL.

Water content of butter made in the Province of Posen, TIEMANN (*Chem. Ztg., 23 (1899), No. 78, p. 942*).—The range observed (number of samples not given) was from 8.69 to 19 per cent, the average being 12.88 per cent.

Analysis of butter from reindeer milk, F. H. WERENSKIOLD (*Aarsber. Offent. Foranst. Landbr. Fremme, 1898, p. 120*).—The sample contained 8.48 per cent water, 86.80 per cent fat, 2.01 per cent protein, 1.87 per cent ash, and 0.84 per cent other substances. The specific gravity of the fat at 100° C. was 0.8653, the refractive index at 45° C. was 38°, the melting point 35 to 40.5°, solidification point 37 to 40°, iodin number 22.85, saponification number 228.5, and Reichert number 27.0.—F. W. WOLL.

Contributions on the spontaneous souring of milk, Y. KOZAI (*Abs. in Centbl. Bakt. u. Par., 2. Abt., 5 (1899), No. 18–19, p. 660*).—The article deals with the kind of lactic acid produced by different bacteria and under varying conditions of temperature, nutrition, etc.

Possibility of distinguishing between raw and cooked milk by chemical reagents, TIEMANN (*Chem. Ztg., 23 (1899), No. 87, p. 942*).—The author has verified the reliability of Storch's tests (hydrogen peroxid and phenylendiamin; E. S. R., 10, p. 384). Milk which had been heated to 75° C. or above gave the reaction, and the reaction was also produced when a small quantity of heated milk was added to raw milk.

Determination of dirt in milk, H. HÖFT (*Molk. Ztg., 13 (1899), No. 35, p. 546*).—The determination of dirt in milk by means of a centrifugal apparatus is described.

Regulations for the sale of milk (*Milch Ztg., 28 (1899), No. 33, pp. 513–515*).—Proposed uniform regulations for the sale of milk in the larger cities of Prussia.

Regulations governing the sale of milk in Saxony (*Milch Ztg., 28 (1899), No. 35, p. 551*).

Law relating to the pasteurization of milk in Denmark (*Milch Ztg., 28 (1899), No. 47, pp. 744, 745*).—Observations on the working of this law, which went into effect June 1, 1899.

Investigation of cream, its specific gravity, fat content, and the yield of butter from same, N. GRIPENBERG (*Nord. Mejeri Tidn., 14 (1899), Nos. 26, pp. 352–354; 27, pp. 367, 368*).

Tuberculosis and milk, J. I. TORRALBAS (*An. Acad. Cien. Med., Habana, 36 (1899), No. 431, pp. 117–121*).

On the occurrence of tubercle bacilli in oleomargarine, MORGENROTH (*Hyg. Rundschau, 9 (1899), No. 10, p. 481*).—A preliminary communication. It is stated as the result of investigation that virulent, true tubercle bacilli not infrequently occur in oleomargarine and that it is quite as important as in the case of butter to stipulate that it shall come into the market free from tubercle bacilli.

On the occurrence of tubercle bacilli in oleomargarine, MORGENROTH (*Hyg. Rundschau, 9 (1899), No. 22, pp. 1121–1135*).—Ten samples of oleomargarine were taken, of both cheaper and more expensive grades. These samples were melted at a temperature of 42 to 50° and treated in a hand centrifuge for 5 minutes. The fat was poured off and the remainder, after being diluted with sterile water, was used for inoculation experiments. Four animals were inoculated with material from each sample. Of the 10 samples 8 were found to be infected with living tubercle bacilli.

Report of the third general Swedish Cheese Exhibition and Dairymen's Convention in Stockholm, 1899, K. F. LUNDIN (*Stockholm, 1899, pp. 92*).

Faults, errors, and losses in cheese making, G. S. THOMSON (*Jour. Agr. and Ind., South Australia, 3 (1899), No. 5, pp. 435–439, fig. 1*).—Includes descriptions of the acid test and the Wisconsin curd test.

Belgian regulations for manufacture and sale of cheese (*U. S. Consular Rpts., 1899, No. 231, p. 634*).

Observations concerning cheese diseases and their remedies, F. BAGGE (*Tidskr. Landtmän, 20 (1899), No. 15, pp. 264–269*).

VETERINARY SCIENCE AND PRACTICE.

The local distribution of tubercle in various species, with reference to the channel of infection, W. HUTCHINSON (*British Med. Jour., 1899, No. 2028, pp. 1350–1352*).—The observations which the author reports in this paper were made chiefly in the London zoological gardens. About 80 *post-mortem* examinations were made upon a considerable variety of mammals and birds. Among the mammals may be mentioned kangaroos, antelopes, armadillos, jackals, llamas, rodents, lemurs, monkeys, and apes. From the examinations which were made it is concluded that in mammals the disease kills almost invariably by the lung. It was noticed that although the lung infection produced the most serious effects upon the animal, yet in only 6 out of 40 cases in mammals was the disease confined to the lungs, and in 7 cases it was confined entirely to the abdomen. In cattle, antelopes, sheep, and gazelles the disease shows a marked preference for the pleura and pericardium. Purulent degeneration of the tuberculous masses seems to be much less frequent in animals than in man.

In birds, on the other hand, the lungs are rarely affected by tuberculosis. The chief seat of the disease in birds is in the abdominal viscera, more especially the liver, spleen, and wall of the intestines. In only 20 per cent of the avian cases which were studied were the lungs affected at all. The chief attack of bird tuberculosis falls upon the liver. It becomes enormously enlarged and crowded with nodules of various sizes. Tuberculosis of the bones and joints is much more common in birds than in mammals.

The question as to whether tuberculosis affects reptiles was not determined by the author's observations. One case in a tortoise seemed to be tuberculosis, but the germs did not respond completely to Koch's tests.

The observations which were made by the author seem to indicate that the main channel of infection is by way of the alimentary tract, and that from this source it spreads to the lungs in mammals far more than in birds, by reason of the apparently greater resistance of the lungs in birds than in mammals.

Contribution to the tuberculin problem, VIQUERAT (*Centbl. Bakt. u. Par., 1. Abt., 26 (1899), No. 10, pp. 293, 294*).—The author has made chemical analyses of tuberculin and tubercle bacillus and finds that the latter consists of an outer layer composed of a salt of palmitic acid which is not easily soluble in water, and an inner portion composed of a salt of succinic acid, which is more easily soluble in water. It is concluded, therefore, that tuberculin is not a proteid, but a definite chemical body. Tuberculin was heated to a temperature of 150 to 200° without its undergoing any change, and it still had the same effect upon tuberculous animals as before heating. Succinic acid plays the chief part in tuberculosis. The tubercle bacillus does not produce a toxin, but operates rather in the way of producing a diathesis. "Tuberculin is nothing but an aqueous solution of an alkaline succinate."

Report of the biologist, J. NELSON (*New Jersey Stas. Rpt. 1898, pp. 229-242*).—An outbreak of abortion in the college herd was checked by systematic disinfection with a 2 per cent solution of creolin, used lukewarm.

In a series of experiments with tuberculin in the college herd, the author found reason to believe that cattle may be infected with tuberculosis for some length of time before they will give a reaction to the tuberculin test, and thus concludes it is necessary to give the test about once a year, or at least once in 2 years, in order to be certain that the disease does not exist in the herd.

Abortion, barrenness, and fertility in sheep, W. HEAPE (*Jour. Roy. Agr. Soc. England, 3. ser., 10 (1899), pt. 2, pp. 217-248*).—The Royal Agricultural Society in 1897 issued circulars asking for information upon the subject of abortion, barrenness, and fertility in the various flocks of sheep throughout Great Britain. Tolerably complete returns were received from these requests concerning 397 flocks, including in all 122,673 breeding ewes. Of these flocks 338 were of pure-bred stock and 59 were crossbred. Eighteen pure breeds of sheep are represented in the returns, but only 8 of them in sufficient numbers to furnish reliable statistics for the breed. The other pure breeds in the count are put together for purposes of comparison with the crossbreeds.

The percentage of abortion which was suffered by 300 sheep owners varied from 23.75 per cent to 0. The Dorset Horn and Lincoln breeds suffered most from abortion, the Southdowns occupying an intermediate position in this respect, while the other pure breeds suffered least.

With regard to the causes of abortion, the observations of the author, based largely upon the experience of different sheep breeders, are set forth under a number of different heads. The statistics collected indicate that shearling ewes are more liable to abort than older ones. Fright from strange dogs, shooting, or thunder, and overexertion from jumping ditches, etc., have been known to cause abortion.

With regard to the locality and subsoil, certain differences in the proportion of abortion were found which would seem to indicate that some soils and some localities are more favorable to abortion than others. The returns show clearly that heavy rainfall occurring during the latter stages of gestation are apt to cause abortion. The above-mentioned factors in the production of abortion are, however, subordinate to the food and general condition of the ewes. From the statistics which the author collected, it was not apparent that any particular feeding stuff which is usually given to sheep was distinctly favorable or unfavorable to abortion. It should be stated, however, that several kinds of fodder, when given in undue quantity or at inopportune times, may precipitate abortion.

The percentage of barrenness reported by 327 sheep raisers varied from 51.42 to 0, the average percentage in 96,520 ewes being 4.71 per cent. Barrenness reaches ordinarily about twice as high a percentage as abortion, and only 3 breeds upon which reports were made showed less than 5 per cent of barrenness. About 2 per cent of the barrenness may be put down to the account of constitutionally barren ewes. A percentage higher than this is to be considered as due to causes which may be prevented. According to the statistics which were collected, barrenness was not perceptibly dependent upon the age of the ewes. It was noticed that barrenness was more frequent when young rams were used than in the case of older ones. The number of ewes per ram varied in the different flocks from 40 to 60. From the collected statistics no definite rules could be formulated regarding the influence of the fatness of the ewes or rams in the determination of barrenness. The total loss from barrenness and abortion was not under 4 per cent for any breed and was usually over 6 per cent.

With regard to fertility, the proportion of lambs reported by 306 sheep raisers varied from 203.8 to 59.09 per cent. The percentage of lambs for

107,603 ewes was 120.4 per cent. The percentage of twins recorded by 237 sheep raisers varied from 85.58 to 2.4 per cent, the percentage for 68,536 being 30.02. It is of interest to note that the fertility was higher in all of the pure-bred than in the crossbred sheep.

With regard to the causes of fertility, a great many factors have been assumed and are believed to contribute to its increase or decrease, but the primary factor would seem to be a constitutional one. It is shown, for instance, from the statistical records that twins are more frequently born from ewes which were themselves twins than from ewes which were single, and the indications are that careful selection of races may increase the fertility to a considerable extent. The percentage of twins which are born in any flock depends upon the constitutional characteristics of the ewe and not upon the ram. The general view of the results obtained by the observations of the author and by the compilation of these statistics, obtained as above indicated, may, perhaps, best be seen in the following table:

Variations in size of flocks and in percentage of lambs, twins, abortion, and barrenness.

Breed.	Number of flocks.	Average size of flock.		Lambs.		Twins.		Abortion.		Barren.	
		Rams.	Ewes.	Highest	Lowest.	Highest.	Lowest.	Highest.	Lowest.	Highest.	Lowest.
				P. ct.	*P. ct*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
Suffolks	38	4	197	180.18	113.53	85.58	24.47	9.81	0	9.09	0
Kents	15	17	662	140.00	107.00	50.00	17.00	3.33	0	11.05	3.88
Southdowns	23	8	397	141.31	60.95	37.69	2.40	13.33	0	51.42	0
Hampshires	53	9	498	150.00	91.71	50.00	7.84	9.83	0	18.33	0
Oxford Downs	20	4	178	167.50	93.75	66.50	15.00	3.82	0	13.00	1.08
Dorset Horns	31	5	331	180.00	84.96	69.34	21.25	23.75	0	10.68	0
Shropshires	60	3	141	192.07	78.66	80.00	47.06	6.66	0	48.00	0
Lincolns	62	6	288	169.28	59.09	66.66	4.16	22.80	0	47.73	0
Various pure breeds	36	5	280	203.80	86.66	69.52	2.65	7.55	0	17.85	0
Total pure breeds	338	6	305	203.80	59.09	85.58	2.40	23.75	0	51.42	0
Crossbreeds	59	7	330	225.00	86.20	81.57	4.03	5.17	0	12.00	0
Total	397	6.8	309	225.00	59.09	85.58	2.40	23.75	0	51.42	0

Tenth annual report on the veterinary service in Hungary, F. HUTYRA (*Jahresbericht über das Veterinärwesen in Ungarn. Budapest: Agr. Dept., 1899, pp. 222*).—This report contains an account of the instruction given in the Royal Veterinary School in Budapest, and of the general veterinary service and veterinary sanitation of Hungary. In the second part of the report numerous observations are recorded concerning anthrax, rabies, glanders, foot-and-mouth disease, pneumonia, sheep pox, mange, hog cholera, and swine plague. A summary is given of the results obtained by a protective inoculation against anthrax, blackleg, and hog cholera. A brief statement is made of the veterinary police regulations.

Infectious lung diseases and the present status of the question of Psittacosis, LEICHTENSTERN (*Centbl. Allg. Gesundheitspfl., 18 (1899), No. 7–8, pp. 241–303*).—An extended discussion of the agency of parrots in transmitting various lung diseases to man. A bibliography is added.

Studies in pathology and clinical symptoms. Experimental researches, P. J. CADIOT (*Études de pathologie et de clinique. Recherches expérimentales. Paris: Asselin & Houzeau, 1899, pp. 618, figs. 65*).—This volume contains a large number of clinical and pathological observations upon various diseases affecting domestic animals. An illustrated account is given of tuberculosis in the horse, in the dog, and in the cat, with extensive bibliographies of the subject for each of these species. Avian tuberculosis also receives an extended discussion at the hands of the author, in the course of which he comes to the conclusion that the tuberculosis of birds and of mammals is due to one and the same organism. Especial attention is devoted to tuberculosis in parrots, and the author calls attention to the frequency of the disease in this species and its relationship to the spreading of human tuberculosis. An account is given of tuberculosis in the goat by Gilbert and Roger. These authors have also assisted in various other parts of the book. Besides tuberculosis, various other diseases are discussed, such as glanders, eczema, endocarditis, infectious pneumonia, etc.

Studies on the resorption of cells, E. METCHNIKOFF (*Ann. Inst. Pasteur, 13 (1899), No. 10, pp. 737–769, pls. 2*).—In this paper the author reports the results obtained by a study of the activity of phagocytes and their relationship to immunity. The general conclusions may be summarized as follows: The resorption of cells is chiefly the work of macrophages. Macrophages may not only seize upon dead cells, but also upon cells which are evidently alive. Red-blood corpuscles of the goose injected into the peritoneum of guinea pigs were entirely devoured by the macrophages. The immunizing substances are probably an excretion of the macrophages at the end of a period of intracellular digestion.

The different reaction of certain micro-organisms in a colored nutrient medium A. CESARIS-DEMEL (*Centbl. Bakt. u. Par., 1. Abt., 26 (1899), No. 18–19, pp. 529–540, pls. 2*).—The author experimented with a number of pathogenic organisms, including that of anthrax, diphtheria, and chicken cholera. The results of these experiments may be briefly summarized as follows: The micro-organisms produce changes in the nutrient media by means of their biological products which furnish a convenient method for differentiating them. One of the most valuable media for this purpose was found to be liver broth stained with tincture of litmus.

The veterinary service in Bosnia and Herzegovina since 1879 (*Das Veterinärwesen in Bosnien und der Hercegovina seit 1879. Sarajevo, 1899, pp. 228, pls. 8*).—An account of the development of the veterinary service, with statistical reports on the extent of various infectious diseases and the preventive and curative methods adopted.

The origin of antitoxin: Is it present in the blood of some normal animals, L. COBBETT (*Lancet [London], 1899, No. 3962, pp. 332–337*).—Of 11 horses examined, 8 were found to possess diphtheria antitoxin in the blood.

On the significance of mixed infection in pulmonary tuberculosis, A. SATA (*Beitr. Path. Anat. u. Allg. Path., 1899, Sup. 3, pp. 179, pls. 2*).—The results of this study may be briefly summarized as follows: In man and animals mixed infection plays an important part in the pulmonary forms of tuberculosis. Mixed infection is usually subsequent to tubercular infection. Pulmonary tuberculosis is pure tuberculosis only in its earlier stages, the majority of advanced cases showing a mixed infection. The latter process is largely responsible for elevation of temperature and pneumonic conditions. The bacteria which are most frequently found in mixed infection are *Streptococcus pyogenes, Staphylococcus pyogenes aureus, Diplococcus pneumoniæ, Pneumobacillus,* and *Pseudodiphtheriabacillus.* Probably a mixed infection does not always hasten the progress of tuberculosis, but may in some cases check the development of the tubercle bacillus.

Concerning the preparation of tubercle bacilli, ROSSO (*Mod. Zooiatro, 10 (1899), No. 10, pp. 182, 183*).—A study on the biological technique of the bacillus of tuberculosis.

The demonstration of tubercle bacilli in the tubercles of beef, P. STAZZI (*Mod. Zooiatro, 10 (1899), No. 9, pp. 164–171, fig. 1*).—A discussion of the methods by which the bacillus is detected.

The frequency of bovine tuberculosis, M. STREBEL (*Schweiz. Arch. Thierh., 41 (1899), No. 6, pp. 264–267*).—A statistical account.

Tuberculosis in the horse, Körner (*Ztschr. Veterinärk., 11 (1899), No 12, pp. 621-624*).—Tuberculin did not give a typical reaction, although the disease was well established.

The importance of tuberculin for diagnostic purposes, Z. Blaustein (*Oesterr. Monatschr. Thierh., 24 (1899), No. 11, pp. 512-513*).

Report on an investigation with regard to the value of tuberculin as a test of the presence of tuberculosis in cattle, J. M. Young (*Veterinarian, 72 (1899), No. 863, pp. 787-790*).—Results obtained by this study are briefly summarized as follows: Tuberculin loses its virulency when kept for any considerable time. It is a reliable diagnostic agent except when the tubercular lesion is minute or where the disease has become generalized. Tuberculous udder is of more frequent occurrence than is usually supposed.

The application of the tuberculin test among cattle on a farm in southern Holland, J. F. Laméris (*Tijdschr. Veeartsenijk. en Veeteelt, 27 (1899), No. 1, pp. 5-16*).—Extensive tables are given showing the temperature reactions and qualities of milk produced during the experiment.

Combating tuberculosis, D. Rosenbusch (*Oesterr. Monatschr. Thierh., 24 (1899), No. 7, pp. 289-293*).—A discussion of the effects of the sanitary regulations of Bosnia and Herzegovina regarding tuberculosis.

The contest against bovine tuberculosis, G. Regner (*Meddel. K. Landtbr. Styr., 1899, No. 55, pp. 29*).

Serum therapy in the treatment of tuberculosis, E. Maragliano (*Berlin. Klin. Wohnschr., 36 (1899), No. 49, pp. 1073-1075*).—By experiments upon guinea pigs and rabbits, the author found that it was possible to obtain an antitoxin which will protect these animals against fatal doses of the tubercle toxin. Of the guinea pigs which were inoculated with tuberculosis and later treated with antitoxin, 50 per cent were cured.

The action of soluble products of Streptothrix on infections produced by Actinomyces farcinicus and on the course of experimental tuberculosis, Sabrazès et al. (*Compt. Rend. Soc. Biol., Paris, 11. ser., 1 (1899), No. 35, pp. 929-930*).—In rabbits the progress of tuberculosis was not retarded by inoculation with these products.

An attempt at treatment of tuberculosis by cultures of the Eberth and coli bacilli, A. Rodet (*Compt. Rend. Soc. Biol., Paris, 11. ser., 1 (1899), No. 34, pp. 907-908*).—Nine guinea pigs were inoculated with human tuberculosis of a low virulence. Three of these animals were kept for control. The other 6 were inoculated 12 days later, 3 with Eberth bacillus and 3 with coli bacillus. They received inoculations at intervals of a few days for a period of nearly 2 months. All the animals which were treated died after from 110 to 200 days, and *post-mortem* examinations showed that the treatment had not checked the progress of the disease in invading the various organs.

The use of serum against anthrax, J. Mendez (*Centbl. Bakt. u. Par., 1 Abt., 26 (1899), No. 20-21, pp. 599-608*).—A serum was produced which exhibited a specific action against anthrax in guinea pigs. Many cases of anthrax in man have been treated with serum in the Argentine Republic. Uniformly good results were obtained. After injection of the serum the temperature falls, the œdematous condition passes away, and the glands assume their normal size. Cattle and sheep were treated with serum for anthrax with excellent results.

The production of toxin by anthrax bacilli, H. Conradi (*Ztschr. Hyg. u. Infectionskrank., 21 (1899), No. 2, pp. 287-316*).—The author gives a review of the literature, with an extensive bibliography. The results of the work may be expressed as follows: Anthrax bacillus produces neither soluble, extracellular, nor intracellular toxin in either susceptible or nonsusceptible animals.

Diseases of cattle that may be mistaken for foot-and-mouth disease, B. Bang (*Maanedsskr. Dyrlæger, 11 (1899), No. 4, pp. 157-166*).

Foot-and-mouth disease, J. WOHLMUTH (*Oesterr. Monatschr. Thierh., 24 (1899), No. 5, pp. 225, 226*).—An account of an outbreak of this disease.

Combating foot-and-mouth disease, D. GAUTIER (*Maanedsskr. Dyrlæger, 11 (1899), No. 8, pp. 273–296*).—A report of the discussion of this disease held during the Seventh International Veterinary Congress.

The etiology of Texas fever, T. SMITH (*New York Med. Jour., 70 (1899), No. 2, pp. 47–51*).—A general discussion of the relationship of the tick to the micro-organism of the disease, with special reference to theories concerning the means of transmission of malaria.

Red water, or Texas fever, A. EDINGTON (*Lancet [London], 1899, No. 3949, pp. 1219, 1220*).—Reports a number of successful experiments in inoculating cattle with the blood of recovered animals.

Inoculation for Texas fever, J. W. CONNAWAY (*Breeders' Gaz., 36 (1899), No. 20, pp. 596, 597, figs. 4*).—A report on recent successful inoculations made at the Missouri Station against this disease.

Bovine tick fever (*Indian Agr., 24 (1899), No. 8, p. 252*).—A brief article on the disease as found in the southern English colonies.

Studies on pleuro-pneumonia, NOCARD ET AL. (*Rec. Méd. Vét., Paris, 8. ser., 6 (1899), No. 22, pp. 430–446*).—A report upon experiments in which the authors determined that serum inoculations may be depended upon both as a curative and preventive measure.

Contagious pleuro-pneumonia of cattle, R. GUISEPPE (*Mod. Zooiatro, 10 (1899), Nos. 19, pp. 372–375; 20, pp. 393–399; 21, pp. 414–418; 22, pp. 431–435*).—An experimental and critical study of the symptoms, treatment, prevention, prevalence, and geographical distribution of this disease.

Experimental production of acute fibrinous pneumonia by pneumococcic toxin, P. CARNOT (*Compt. Rend. Soc. Biol., Paris, 11. ser., 1 (1899), No. 35, pp. 927–929*).

The preventive properties of the blood serum of an immunized heifer as used against contagious pleuro-pneumonia, ARLOING and DUPREZ (*Jour. Méd. Vét. et Zootech., 5. ser., 3 (1899), pp. 641–645*).

Recent work in the production of immunity against blackleg, H. VALLÉE (*Rev. Vét. [Toulouse], 24 (1899), No. 12, pp. 726–737*).

Preventive inoculation against blackleg, T. KITT (*Monatsh. Prakt. Thierh., 11 (1899), No. 2, pp. 49–62*).—By inoculating horses, sheep, goats, and cattle with blackleg virus the author was able to obtain a serum which protected sheep against a fatal subcutaneous dose of fresh or dry blackleg material. The immunity thus produced persisted in the experimental animals for 2 months. Similar experiments were not tried on cattle, on account of the expense connected with buying such animals.

Malignant œdema in cattle, J. C. POUND (*Queensland Agr. Jour., 5 (1899), No. 5, pp. 505–508, figs. 2*).—A description of an outbreak of this disease, with an account of the *post-mortem* findings and of the growth of the pathogenic organism upon different culture media.

The rational treatment of milk fever of the septic form, G. GAMBAROTTA (*Mod. Zooiatro, 10 (1899), No. 10, pp. 191–196*).—Recommends strict antiseptic methods.

The anatomy of the udder and its diseases, L. B. BRANTE (*Nord. Mejeri Tidn., 14 (1899), No. 32, pp. 436–438*).

Poisoning of cows from moldy hay, O. STENSTRÖM (*Nord. Mejeri Tidn., 14 (1899), No. 27, pp. 368, 369*).

Poisoning of cattle by reed meadow grass (Glyceria aquatica), E. SCHOUG (*Landtmannen, 10 (1899), No. 28, pp. 455–457*).

Some poisonous plants, G. B. PLOTTI (*Clin. Vet., 22 (1899), No. 43, pp. 507–509*).—Several cows were poisoned by eating *Æthusa minor* and *Conium maculatum*. Rubbing the body with camphorated oil, giving clysters of ammonia and alcoholic stimulants by way of mouth were only partially effective.

The etiology of omphalitis in calves, A. WILHELMI (*Landw. Jahrb. Schweiz, 13 (1899), pp. 121-134, pl. 1*).—In the study of this disease 15 different organisms were investigated. *Bacterium coli commune* and *B. septicæmiæ hæmorrhagicæ* were the only ones which produced pathogenic effects in inoculation experiments. The author gives tables of temperatures and the *post-mortem* findings in a number of calves which died of the disease. *Bacterium coli commune* is considered to be the pathogenic organism of omphalitis. The disease arises from a local infection by this organism.

Endoglobular hæmatozoa of sheep, LAVERAN and NICOLLE (*Compt. Rend. Soc. Biol., 11. ser., 1 (1899), No. 30, pp. 800-802*).—An epizootic of sheep near Constantinople was studied by the authors. It was found that the blood, and especially the spleen, contained large numbers of a parasitic organism. The disease seemed to be the same as that known in Roumania by the name of carceag. The authors believe that the hæmatozoon which they found in the blood is closely related to the organism of Texas fever, and should be placed in the same genus as the latter, and known therefore by the name *Piroplasma (Pyrosoma) ovis*.

Liver fluke in the spleen of sheep, S. VON RATZ (*Centbl. Bakt. u. Par., 1 Abt., 26 (1899), No. 20-21, pp. 616-618*).—Notes on *Distomum hepaticum* found in this situation.

A new pathogenic Streptothrix, SILBERSCHMIDT (*Ann. Inst. Pasteur, 13 (1899), No. 11, pp. 841-853, figs. 5*).—*Streptothrix capræ* was found to be the cause of a disease of goats which closely resembles tuberculosis. The organism was grown on various nutrient media. Inoculation experiments were conducted upon rabbits, guinea pigs, and white mice. In the rabbit, subcutaneous injections produced tubercles in various organs, and the structure of the tubercles was similar to that of tubercles caused by Koch's bacillus. White mice withstood the action of the organism, although an abscess was formed at the point of inoculation. Guinea pigs were affected in nearly the same manner as rabbits.

Etiological studies on swine plague and swine septicæmia, H. PREISZ (*Ztschr. Tiermed., 2 (1898), No. 1, pp. 1-66*).—An extensive experimental investigation of the cause of swine plague. The author devoted especial attention to the effects of mixed infection in this disease, and upon the production of immunity. A bibliography is added to the article.

The resisting power of the organism of hog cholera, J. KARLINSKI (*Oesterr. Monatschr. Thierh., 24 (1899), No. 3, pp. 122-130*).—A study of the effect of heat and chemical antiseptics upon the organism of hog cholera.

Swine plague, T. KASPAREK (*Oesterr. Monatschr. Thierh., 24 (1899), No. 11, pp. 481-492: 12, pp. 529-537*).—An experimental study of the bacteriology, symptoms, and treatment of swine plague. An extensive bibliography is appended to the article.

Protective inoculation against hog cholera, MARKS (*Berlin. Tierärztl. Wchnschr., 1899, No. 46, pp. 553, 554*).—Out of 14,320 animals inoculated, 54 died as a result of the inoculation.

Eradication of hog cholera in Austria (*Oesterr. Monatschr. Thierh., 24 (1899), No. 8, pp. 365-369*).

Feeding experiments with American pork, J. BÖHM (*Ztschr. Fleisch u. Milchhyg., 10 (1899), No. 3, pp. 41, 42*).—Pork infested with trichinæ was fed to rats to determine the question whether the trichinæ had been killed by the salt. The rats did not become infested.

Chronic cough of young pigs, TEETZ (*Berlin. Tierärztl. Wchnschr., 1899, No. 47, pp. 566-567*).—The mortality from this disease usually reaches from 40 to 60 per cent. The symptoms of the disease are described by the author. The lungs are affected and show a hepatization, but the affection is not related to swine plague.

The use of Hayem serum in puerperal septicæmia of swine, C. FABRETTI (*Mod. Zooiatro, 10 (1899), No. 22, pp. 426-428*).

Airol, W. EBER (*Ztschr. Tiermed., 2 (1898), No. 3, pp. 161-168*).—The antiseptic power of this substance is about the same as that of iodoform. Experimental studies are reported in regard to its effects on a number of bacteria.

AGRICULTURAL ENGINEERING.

Water-right problems of Bear River, C. T. Johnston and J. A. Breckons (*U. S. Dept. Agr., Office of Experiment Stations Bul. 70, pp. 40, pls. 9*).—This bulletin discusses the subject of interstate water rights as illustrated in the Bear River Valley, and is the third of a proposed series of bulletins of "information regarding the actual status of irrigation in the arid region." Previous bulletins of the series are Bulletins 58 and 60 of this Office (E. S. R., 11, pp. 95, 96). The Bear River "was chosen for study because in its course of a little over 300 miles it crosses State lines (Wyoming, Idaho, and Utah) five times, finally emptying into Salt Lake, which is less than 50 miles distant from its source, thus presenting in small compass a great variety of interstate problems, and offering exceptional opportunities for the inauguration of this class of inquiries."

Water-supply engineering, A. P. Folwell (*New York: John Wiley & Sons, 1900, pp. XIV+562, ill.*).—This book treats of "the designing, construction, and maintenance of water-supply systems, both city and irrigation."

Hartz River Valley irrigation scheme; reports of H. C. Litchfield, engineer in charge, to the chief inspector of public works, Cape of Good Hope, and covering letters by the chief inspector (*Capetown: W. A. Richards & Sons, 1899, pp. 53, map 1*).

Irrigation by artesian water (*Queensland Agr. Jour., 5 (1899), No. 5, pp. 459, 460*).—A brief account of such irrigation in Queensland.

Reservoir survey, F. H. Newell (*Irrig. Age, 14 (1899), No. 3, pp. 79–82*).—An explanation of the relation of the United States Geological Survey to this work.

Duty of water—general instructions to observers, E. Mead (*U. S. Dept. Agr., Office of Experiment Stations, Irrig. Invest. Schedule 2, pp. 4, figs. 2*).—This circular gives general instructions for the measurement of water used in irrigation, including directions for the construction of a Cippoletti weir and a measuring flume, and a table showing the discharge over weirs of various dimensions.

The prevention of water-right litigation, S. Fortier (*Irrig. Age, 14 (1899), No. 3, pp. 83–89*).—The main features of the system proposed and upon which it is claimed the majority of western people are agreed are as follows:

"(1) The creation in each State of a central bureau of irrigation to which all data pertaining to this subject should be forwarded and from which information could be obtained.

"(2) The appointment of competent parties to collect and collate the physical facts pertaining to the irrigable lands and the appropriated waters with a view to the final settlement of all water rights.

"(3) The establishment of a special tribunal to grant water titles for a nominal sum on the basis of carefully determined facts rather than on the conflicting evidence of a large number of volunteer witnesses.

"(4) The organization of an efficient administrative system to divide equitably the utilized waters of the State."

Form for weekly record of use of irrigation water (*U. S. Dept. Agr., Office of Experiment Stations, Irrig. Invest. Schedule 1*).

Kinematics of machinery, J. H. Barr (*New York: John Wiley & Sons, 1899, pp. V+247, figs. 213*).—"This little book is intended as a text-book for use in the general course in mechanical engineering schools, or for use by draftsmen and others who may desire to study the methods of graphical analysis of machine motions."

Report on highways in Maryland (*Rpt. Maryland Geol. Survey, 3 (1899), pp. 461 + 80, pls. 35, figs. 38*).—This includes articles on The highway investigations by the Maryland Geological Survey and The relations of Maryland topography, climate, and geology to highway construction, by W. B. Clark; Highway legislation in Maryland and its influence on the economic development of the State, by G. L. Sioussat; The present condition of Maryland highways and Construction and repair of roads, by A. N. Johnson; Qualities of good road metals and the methods of testing them, The administration of roads, including the method and expense of road improvements, and The advantages of good roads, by H. F. Reid. The laws of Maryland relating to highways are given in an appendix.

STATISTICS—MISCELLANEOUS.

Twenty-second Annual Report of Connecticut State Station, 1898 (*Connecticut State Sta. Rpt. 1898, pp. 341 + XIV*).—This is made up of a number of articles abstracted elsewhere and a brief general report including the organization list of the station, various announcements, an outline of station work by the board of control, and a report of the treasurer for the year ended September 30, 1898.

Annual Report of New Jersey Stations (*New Jersey Stas. Rpt. 1898, pp. XIX + 467, pls. 30, figs. 5, maps 2, dgms. 2*).—This includes a financial statement of the State station for the year ended October 31, 1898, and of the college station for the fiscal year ended June 30, 1898; a report of the director reviewing the work of the different departments; reports of the chemists, assistant in horticulture, assistant in dairy husbandry, biologist, botanist, and entomologist, abstracted elsewhere; and a reprint of Bulletin 133 of the station on peach growing (E. S. R., 11, p. 51).

Report of the Department of Agriculture of Norway for 1898 (*Aarsber. Offent. Foranst. Landbr. Fremme, 1899, pp. LXXIX + 487*).

The needs of Agriculture (in Russia) and the measures required for meeting them (*St. Petersburg: Min. Agr. and Imp. Domains, 1899, pp. 316; rev. in Selsk. Khoz. i Lyesov., 192 (1899), Mar., pp. 707, 708*).—The first and greatest need is said to be the necessity of a broad diffusion of general education and agricultural information as well as of special agricultural education. Among the other most essential measures recommended are a decrease of the import duties, diminution of various taxes, a broad organization of government credit, a change of the railway transportation charges, etc.—P. FIREMAN.

University extension in agriculture, A. C. TRUE (*Forum, 1900, Feb., pp. 701–707*).

Fourth report of committee on methods of teaching agriculture (*U. S. Dept. Agr., Office of Experiment Stations Circ. 41, pp. 7*).—A syllabus for a course of instruction in zootechny submitted as a report of progress to the convention of the Association of American Agricultural Colleges and Experiment Stations, held at San Francisco, Cal., July 5–7, 1899. Zootechny as a division of technical agriculture is limited by the committee to the theory and practice of the production of normal animals useful to man. The general topics in the outline are as follows: (1) Principles governing the choice and breeding of animals; (2) types and breeds of different kinds of animals; (3) principles of feeding; (4) practice of feeding different kinds of animals; (5) principles of hygiene and management, and (6) practice in the management of different kinds of animals.

A German common school with a garden, C. B. SMITH (*U. S. Dept. Agr., Office of Experiment Stations Circ. 42, pp. 7, figs. 2*).—The greater number of common schools in the smaller villages of Germany are described as having attached to them a small garden intended primarily for the use of the teacher. The ways in which this garden is occasionally made a means of instruction are pointed out, and one of the better schools of this kind, located at Alfter, in the German Rhine Province, is described in full. Instruction in fruit culture, gardening, and general farming is given 2 hours each week during the last 2 years of the course. Outline suggestions for this work as furnished by the provincial government are included in the circular.

NOTES.

Idaho University and Station.—A very successful farmers' short course of 10 days has been held at the university, which was an innovation in the State. The course was attended by 32 farmers and orchardists, who manifested the keenest interest in all the instruction imparted. Just previous to this short course the station conducted a farmers' institute at the university, which was largely attended.

Purdue University.—President J. H. Smart died February 21, 1900. Dr. Smart was for 27 years a member of the Indiana State board of education, served 3 terms as State superintendent of public instruction, and had been president of Purdue University since 1883.

Maine Station.—G. M. Gowell, formerly agriculturist, has been placed in charge of the department of stock breeding and poultry, and L. J. Shepard has become assistant agriculturist instead of assistant horticulturist.

Michigan Station.—T. T. Lyon, for the past 10 years in charge of the Michigan Fruit Substation at South Haven, died February 6, at the age of 87 years. Mr. Lyon has been actively interested in American horticulture for 60 years, and for many years has taken a prominent part in the work of the pomological society of his State and of the American Pomological Society.

Missouri Station.—J. G. Babb has been appointed secretary of the station in connection with his regular duties as secretary of the board of curators of the University, and Irvin Switzler, former secretary of the station, has been transferred to other university work.

Nevada University and Station.—P. B. Kennedy, of the Division of Agrostology of this Department, has been appointed associate professor of botany and horticulture in the university and station, and will enter upon his duties about July 1.

Oklahoma Station.—W. E. Bolton, secretary of the Oklahoma Live Stock Association, Woodward, Okla., has been appointed a member of the board of regents, vice J. D. Ballard, resigned.

South Carolina Station.—Incubator and brooder rooms have been added to the equipment of the poultry division.

Tennessee Station.—At a recent meeting of the board of trustees money was appropriated to erect a dairy building. This building will be 40 by 80 ft., of brick, 2 stories in height, with slate roof, and cement floor in the basement. It will have about 7,000 ft. of floor space, and the most complete machinery for dairy instruction will be installed. It will be used for instruction in commercial dairying, farm dairying, the manufacture of butter and cheese, and milk testing, and also for the experimental work in dairying.

Texas College and Station.—According to a recent decision of the State court of appeals (supreme court), the tenure of office of the trustees of public schools, regents of the State University, and directors of the Agricultural and Mechanical College is restricted to 2 years, because of constitutional limitation.

Necrology.—Prof. Carl Lintner, formerly director of the Bavarian Agricultural Central School, died at Munich January 14, 1900, at the age of 72 years, after a long illness. Professor Lintner had for many years devoted much attention to the science and practice of brewing and became the first authority on that subject. He inaugurated a very successful course in brewing at the agricultural school, which long since grew into an independent department, and in 1874, in company with Dr. Reischauer, he established at Munich the first experimental station for brewing, which was later adopted by an association of brewers.

O

EXPERIMENT STATION RECORD.

VOL. XI. NO. 9.

The statistics of the educational institutions receiving the benefits of the acts of Congress of July 1, 1862, and August 30, 1890, recently collated by this Office for the year 1899, show no change in the number of these institutions. In the United States, exclusive of Alaska, Hawaii, Porto Rico, and the Philippines, there are 64 such institutions, of which 61 maintain courses in agriculture.

The aggregate value of the permanent funds and equipment of the land-grant colleges and universities in 1899 is estimated to be as follows: Land-grant fund of 1862, $10,262,944; other land-grant funds, $1,441,577.38; other permanent funds, $14,442,194.25; land grant of 1862, still unsold, $4,062,850.30; farms and grounds owned by the institutions, $5,543,108.91; buildings, $16,009,274.53; apparatus, $1,955,859.21; machinery, $1,373,696.75; libraries, $1,854,942.21; miscellaneous equipment, $1,997,690.07; total, $58,944,137.61. The income of these institutions in 1899, exclusive of the funds received from the United States for agricultural experiment stations, was as follows: Interest on land grant of 1862, $624,672.88; interest on other funds, $651,864.85; United States appropriation under act of 1890, $1,120,778.96; State appropriation (annual or regular), $1,679,536.99; State appropriation (occasional), $608,380.99; tuition fees, $580,946.45; incidental fees, $177,343.91; miscellaneous, $550,512.58; total, $5,994,037.61. The value of the additions to the permanent endowment and equipment of these institutions in 1899 is estimated as follows: Permanent endowment, $1,411,325.29; buildings, $452,033.19; library, $117,693.99; apparatus, $120,901.23; machinery, $115,336.20; miscellaneous, $147,862.53; total, $2,365,152.43. The number of persons in the faculties of the colleges of agriculture and mechanic arts were as follows: For preparatory classes, 315; for collegiate and special classes, 1,669; total, 1,878. In the other departments the faculties aggregated 1,015, making a grand total of 2,893 persons in the faculties of the land-grant institutions. The students in 1899 were as follows: (1) By classes—preparatory, 6,658; freshmen, 7,093; sophomores, 4,500; juniors, 3,715; seniors, 2,846; special, 10,399; post graduate, 745; total, 35,956. (2) By courses—agriculture, 4,407; mechanical engineering, 3,355; civil engineering, 1,463; electrical engineering, 1,325; mining engineering, 713; architecture, 410; household economy, 1,573; veterinary science, 646; military tactics, 10,416. The graduates in 1899 were 2,232, and since the organization of these institutions 39,084. The average age of graduates in 1899 was 22 years 2 months. The total number of volumes in the libraries was 1,463,845. The total number of acres of land granted to the State under the act of 1862 was 9,359,241, of which 985,833 are still unsold.

Agricultural experiment stations are now in operation under the act of Congress of March 2, 1887, in all the States and Territories. Agricultural experiments have been begun in Alaska with the aid of national funds, and an experiment station is in operation in Hawaii under private auspices. In each of the States of Alabama, Connecticut, New Jersey, and New York a separate station is maintained wholly or in part by State funds, and in Louisiana a station for sugar experiments is maintained partly by funds contributed by sugar planters. Excluding the branch stations established in the several States, the total number of stations in the United States is 54. Of these 52 received the appropriation provided for in the act of Congress above mentioned. The total income of the stations during 1899 was $1,143,334.93, of which $720,000 was received from the National Government, the remainder, $423,334.93, coming from the following sources: State governments, $240,300.20; individuals and communities, $12,100; fees for analyses of fertilizers, $75,294.42; sales of farm products, $69,312.60; miscellaneous, $26,327.71. In addition to this the Office of Experiment Stations had an appropriation of $40,000 for the past fiscal year, including $10,000 for the Alaskan investigation. The value of additions to equipment of the stations in 1899 is estimated as follows: Buildings, $27,218.64; libraries, $10,796.15; apparatus, $16,917.07; farm implements, $10,784.88; live stock, $16,265.95; miscellaneous, $22,521.93; total, $104,504.62.

The stations employ 678 persons in the work of administration and inquiry. The number of officers engaged in the different lines of work is as follows: Directors, 71; chemists, 148; agriculturists, 68; experts in animal husbandry, 9; horticulturists, 77; farm foremen, 21; dairymen, 23; botanists, 52; entomologists, 48; veterinarians, 26; meteorologists, 17; biologists, 7; physicists, 7; geologists, 5; mycologists and bacteriologists, 20; irrigation engineers, 5; in charge of substations, 16; secretaries and treasurers, 24; librarians, 9, and clerks, 43. There are also 48 persons classified under the head of "miscellaneous," including superintendents of gardens, grounds, and buildings, apiarists, herdsmen, etc. Three hundred and eight station officers do more or less teaching in the colleges with which the stations are connected.

During 1899 the stations published 445 annual reports and bulletins, containing 16,924 pages. Besides regular reports and bulletins, a number of the stations issued press bulletins, which were widely reproduced in the agricultural and county papers. The mailing lists of the stations aggregate 523,970 addresses.

In his report on the work and expenditures of the stations for the year ended June 30, 1899, the Director of this Office makes the following general statements:

The work of the stations during the past year has for the most part been along the same lines as heretofore, and in the aggregate a large amount of useful work has been accomplished. By their own efforts and with the aid of the colleges of agriculture and the State boards or commissioners of agriculture the stations are bringing their work home more closely to the farmers through publications, farmers' institutes, agricultural associations, home reading courses, and the press. It is becoming evident that farm practice in this country is being materially affected by the work of the stations, and they are more and more relied upon by our progressive farmers for advice and assistance.

The wisdom of Congress in making the Hatch fund a research fund is every year becoming more apparent. This Department is therefore disposed to more strongly insist on a strict interpretation of this act in this direction, and to hold that it is not only in accordance with the obligation, but also to the interest of the States, to devote the Hatch fund to investigations in agriculture and to supplement this fund as far as may be necessary to promote the interests of agriculture in other lines.

The movement for the improvement of courses of agriculture in the colleges with which the stations are connected is steadily growing. The past year has witnessed many changes for the better as regards specialization of the work of instruction and the development of courses suited to the varied needs of students. More than ever before the colleges are reaching out beyond their class rooms and are carrying useful instruction to the farmers through farmers' institutes, correspondence courses, and other forms of so-called university extension. As this outside work becomes better organized it is more apparent that it belongs to the college rather than the station.

As the work of both college and station grows in extent and complexity, it becomes more apparent that in order to perform the most efficient service the station should be organized strictly as a separate department of the institution with which it is connected, and that it should have an organization so compact that its work may proceed in accordance with a schedule carefully planned and energetically administered. To secure this end, experience shows that it is quite desirable that the station should have a competent executive officer, who can devote his time very largely to planning and directing its operations, managing its general business, and representing its interests before the public. It is encouraging to observe that in several States during the past year these considerations have led to the more complete separation of the business of the station from the general business of the college, and to the appointment of a director of the station as a separate officer.

From the very first the stations in this country have been largely engaged in the inspection of commercial fertilizers, and this work has been so efficiently and usefully conducted that from time to time additional inspection duties have been laid upon the stations. The movement for the establishment of different kinds of inspection service under authority of the National and State governments is growing apace, and it is very important that the relations of this work to the other functions of the stations should be clearly understood. Soon after the establishment of the stations under the Hatch Act this Department ruled that the funds appropriated under this act could not be legitimately applied to pay the expenses of the inspection and control of fertilizers. The same principle holds good with reference to other forms of inspection service demanded of the stations. While the methods and usefulness of inspection in any particular line are still problematical it may be justifiable for a station to take up this work to a limited extent, but as soon as it becomes a matter of routine business the State should provide funds for its maintenance. If it seems expedient that any part of the inspection service should be performed by the station under State laws and at State expense, the matter should be so arranged as not in any way to interfere with the investigations of the station. It is a great mistake to divert the time and energy of a competent investigator to the toilsome routine work of inspection service.

The number and importance of the experiments which the stations are conducting in cooperation with practical farmers and horticulturists have greatly increased of late. Thousands of such experiments are now annually conducted in the United States. These range all the way from simple tests of varieties of plants to special experiments in the management of farm or horticultural crops, live stock, or particular operations, such as tobacco curing. It is coming to be more clearly recognized that the field operations in agriculture or horticulture conducted on the station farm need to be supplemented by similar work in a considerable number of localities in order to be of general usefulness to the State. By going into different localities, as the needs of its work demand, the station can make itself more useful to the State as a whole. Without doubt cooperative experiments need to be very carefully planned and thoroughly supervised to be successfully conducted, and their success depends on their quality rather than their number. It is encouraging to observe that more careful attention is being given to this important matter by station officers, and it is believed that this work may be made much more economical and useful than the permanent substations as ordinarily managed.

ADAPTATION OF METHODS OF CULTIVATION AND MANURING TO THE PHYSICAL PROPERTIES OF SOILS.

EWALD WOLLNY, PH. D.,

Professor in the Technical High School at Munich.

In a previous article (E. S. R., 11, p. 604) various questions suggested by the relations of the physical properties of soils to the growth of plants were considered, from the standpoint of the soil. It is evident from the facts there pointed out, however, that it is necessary to also consider the subject from the standpoint of the plant in order that those methods of culture may be adopted which will prove most effective under given conditions of soil and systems of manuring. It is this phase of the subject which is discussed in the following pages.

Plants vary widely in their requirements as regards temperature, moisture, and texture of the soil, and these differences must be taken into consideration in the selection of crops to be cultivated. Detailed scientific investigation is needed, however, on this point, for our knowledge of this phase of the subject is almost entirely based on experience.

The rotation of plants which should be adopted is an important question, which can not be answered on chemical or purely agricultural grounds. To answer this question satisfactorily, the texture of the soil and its relation to water must be known. Plants requiring large amounts of water should, as a rule, precede those which do not require much water, or those which are not to be planted for several months after the first crop, during which time the soil lies fallow and has an opportunity to become thoroughly wet. In case of those plants which furnish little shade to the soil, or which have long periods of growth (perennial forage plants), the soil becomes hard, and should be allowed to lie fallow in order to acquire the mechanical condition necessary for other crops. The compacting of the soil during the cultivation of perennial forage plants is a matter of great practical importance, because it results in case of fine-grained soils in so limiting the quantity of air that normal decomposition of organic matter[1] is interfered with, processes of deoxidation are set up, and the fertility of the soil diminished. For these reasons crops having long periods of growth should be avoided as much as possible on soils of this kind. The injurious effect of lack of cultivation is most strikingly illustrated in meadows in which the deficiency of air results in an abnormal decomposition of the remains of the plant roots forming large accumulations of humus or turf. As ordinary means (direct removal of water, treatment with lime, and manuring) are, as experience has shown, insufficient to satisfactorily correct the unfavorable condition in question, it would seem that we ought to abandon the traditional system of meadow cultivation and replace it by one better adapted to natural requirements. The greatest advantages are unquestionably offered by that system which replaces meadow culture by field culture for a short time. In the case of these so-called "rotation meadows" (*Wechsel-wiesen*) the soil, as soon as it begins to show injury from the continuous growth of forage plants, is quickly restored to a favorable condition by plowing and by cultivation in hoed crops, which require frequent stirring of the soil.

---

[1] E. Wollny: Die Zersetzung der organischen Stoffe und die Humusbildungen in Rücksicht auf die Bodencultur. Heidelberg: Carl Winter, 1897 (E. S. R., 8, p. 879).

In the case of mixed culture, *i. e.*, where two or more crops are raised at the same time on the same field, the condition of both temperature and moisture must be taken into consideration. On soils of low water capacity and great permeability and in which the water content varies widely with the precipitation, the best results will be obtained by growing a mixture of crops with variable water requirements. This is true both for grain and for forage plants. Under such conditions mixed culture is much more reliable than the cultivation of a single crop. In the warmer climates, where the temperature of the soil often rises to a point dangerous to many plants, mixed culture may be practiced to advantage as follows: Plants that require heat and that grow to considerable height (fruit trees, vines on trellises, mulberry trees, etc.) are planted in rows, and the shaded strips of land lying between the rows are devoted to plants, such as the various cereals, which require considerable amounts of moisture and comparatively low temperatures. In warm climates with an insufficient supply of moisture special provision must be made for conserving the soil moisture in the case of such plants as hops, vines, etc. Under such conditions these plants should be trained so as to shade the ground as much as possible, and thus to reduce evaporation.

The relation of the physical properties of the soil to the planting and germination of seed[1] remain to be considered. Among the factors of prime importance in this connection is temperature. As is well known, germination begins at a certain minimum temperature, which varies widely with different plants and different varieties. Activity of germination increases with temperature up to a certain limit (optimum), but declines after this limit is passed, until it entirely ceases at a certain maximum temperature. In the colder climates, in which the temperature at seed time rarely rises above the optimum limit, it is necessary to pay close attention to the minimum temperatures of germination, especially in the spring. The seed must not be planted before the soil has reached the minimum temperature required by each plant, otherwise the seed lies in the soil without germinating and is likely to be destroyed. Such care is not necessary in the autumn, because unless the time of planting is very much delayed the soil is still comparatively warm, germination proceeds rapidly, and the dangerous period of early growth is easily passed. In the warmer climates, as well as in colder climates during the summer, the temperature may pass beyond the maximum limit for certain plants and serious injury result.

---

[1] E. Wollny: Saat und Pflege der landwirthschaftlichen Culturpflanzen. Berlin: Paul Parey, 1885. Die Cultur der Getreidearten. Heidelberg: Carl Winter, 1887.

Another factor of equal importance with temperature in determining the time of planting is the moisture of the soil. In case of soils which have a low water capacity and readily dry out in the upper layers, planting must be done while the soil is still moist; that is, as early in spring as the temperature will permit. On the other hand, planting should not be done when soil is too wet, since in wet soils the supply of oxygen is insufficient for germination. Soils should be cultivated only when they have dried out sufficiently so that the air can enter without hindrance.

The rate of seeding must be determined largely by the physical properties of the soil, since the amount of water at the disposal of the plant is, as already shown, so largely dependent upon these properties. The larger the available supply of water in the soil the closer the seed may be planted. The disadvantages of close planting become more evident as the storage capacity of the soil for water diminishes. They are most marked in case of sandy soils and others of loose structure resting upon a permeable subsoil. In such cases the water supply is comparatively limited, and close planting would be a serious mistake. Even under most favorable conditions the yield would be reduced, while under unfavorable conditions—for example, during a long drought—the plants would die for lack of moisture. Under certain conditions close planting may be desirable in case of soils of high water capacity, in order that the increased transpiration from the plants may remove the excess of water from the soil. A further reason for the use of more seed on soils of close texture than on those of loose texture is the fact that in the former the conditions are not favorable to complete germination or to extensive growth of roots.

In determining the proper depth of planting, the principal factors to be considered are aeration, moisture supply, and texture of the soil. In light, loose soils, which dry out readily, seed should be planted deeper than in close, heavy soils, which dry out slowly. There is no danger in deep planting on the lighter soils, because their porosity is such that air readily penetrates them to considerable depths. Light covering of the seed in case of heavy, fine-grained soils is advisable, because such soils have little permeability for air and their particles cohere so strongly that a crust is likely to be formed that offers great resistance to the growth of the young plantlets.

The physical properties of soils furnish a guide in the use of manures.

Considering first the most important fertilizer, barnyard manure, several important rules based upon the properties of soils in their relation to the decomposition of organic matter and the assimilation of plant food may be laid down. These rules are as follows: In clayey, fine-grained soils, in which decomposition proceeds slowly and percolation of water is inconsiderable, stable manure is most effective when worked into the soil in a condition of advanced decomposition. In these soils, however, in which organic matter decomposes rapidly and percolation is copious, it is better to use stable manure in a condition of less advanced decomposition, in order to prevent a possible loss of its fertilizing constituents by leaching. The objection frequently made to this procedure, that the soil does not contain the moisture necessary for decomposing coarse manure, does not hold if the manure is not covered too deep and if proper precautions are taken to reduce evaporation.

The physical properties of the soil must also be taken into account in determining the rate, time, and depth of application of manure which will give the best results. Large applications of manure on light, sandy soils may result in a loss of much of the fertilizing constituents of the manure by leaching, because such soils have little power of absorbing and retaining the soluble fertilizing constituents which are rapidly formed under these conditions. In view of these facts, it seems advisable that (1) sandy soils should not be heavily manured at any one time, but should receive frequent small applications; (2) the manure should be applied to the soil only a short time before the seed is planted and should be plowed in, and (3) it should be applied at a greater depth than in heavy soils. These rules should be observed more carefully the farther the decomposition of the manure has already advanced. In clayey, fine-grained soil, in which organic matter decomposes slowly, percolation is comparatively small, and the absorptive power of the soil for fertilizing constituents considerable, the manure should be used in larger quantities and less frequently, and it should be worked into the soil a longer time before cultivation. Furthermore, it should not be applied at a great depth (about 3 to 5 inches) below the surface, because only under such conditions can decomposition proceed properly in such soils. If manure is applied at greater depths in such soils, abnormal decomposition (putrefaction), due to lack of air, takes place, resulting in the formation of peat-like substances in the soil, which resist further decomposition for years.

The principal factors to be considered in the use of commercial fertilizers are water capacity, permeability of the soil, and percolation. With a limited supply of moisture in the soil, applications of materials containing readily soluble salts exert a harmful influence, both on germination and on the later growth of plants. If the precipitation is excessive and infrequent, a considerable proportion of the fertilizing constituents may be lost in soils of low-water capacity, the loss being greater the less the absorptive power of the soil. In such cases commercial fertilizers containing soluble salts should be applied in smaller quantities, but rather more frequently than on close compact soils or those which contain considerable amounts of humus. It might be advisable in case of sandy soils to use less soluble fertilizers, which are gradually transformed into a condition in which they are capable of assimilation. This is true especially of phosphoric acid, which is best applied on such soils in the form of bone dust or Thomas slag. The greatest care must be exercised in the use of fertilizers containing nitrogen in the form of nitric acid or ammonium salts (nitrate of soda, ammonium sulphate), since the soils have little absorptive power for these substances and they are readily removed by percolation. Such fertilizers should be applied only a short time before planting. With fine-grained, clayey soils and others which easily puddle and form a crust, care must be exercised to preserve a loose, crumbly condition of the surface soil, so that the supply of air may be sufficient to prevent decomposition of the nitrates and the escape of the nitrogen in the free state. As regards the danger of loss of fertilizing constituents, especially nitrates, by leaching, it should be remembered that percolation is likely to be greatest in a bare soil at the same time that the formation of nitrates is most active, *i. e.*, during the warmer portion of the year. The extent to which fertilizing constituents are lost by leaching of bare soils depends upon (1) the length of time the soil lies fallow, (2) the physical and chemical properties of the soil, and (3) the temporary conditions in the particular soil.

When, as in case of black fallow, the land lies bare for about a year a considerable quantity of the more readily soluble fertilizing constituents found in the soil, principally nitrates, are lost in the drainage waters, the amount of such loss varying with the precipitation and with the permeability of the soil. During the short periods between the growth of different crops, in which the soil must necessarily lie fallow on every farm, the extent of the loss depends upon the condition of the soil at the harvest of one crop and the length of time before the succeeding crop is planted. If a soil is allowed to lie fallow after a crop which has thoroughly used up its moisture or after a period of drought, loss of nitrates or other soluble constituents need not be feared, even if the planting of another crop is delayed until autumn. If, however, the soil contains considerable moisture at the time of harvesting a crop, and the land lies fallow over winter, some loss is unavoidable, especially if the season is wet and the soil permeable. In soils of the latter character, which often possess small absorptive power (sandy soils), the loss by leaching may include not only nitrates, but also the mineral constituents of the soil. In fine-grained soils, and those rich in humus, the losses resulting from lying fallow are not so large as in case of light soils, because of their greater absorptive power and less permeability. However, the loss, especially of nitrates, may be considerable even in these soils. The larger part of the nitrates formed during the summer remain in the soil until winter, provided the nitrates have been formed almost exclusively in the upper layers of the soil and have remained there. Crops planted in the spring following a dry winter find a large supply of nitrates in the soil. If, however, the summer during which the field has lain fallow is followed by a wet autumn and winter, the nitrates produced are largely lost by leaching.

For the purpose of preventing or reducing the losses, especially of nitrates, under such conditions, it seems to be advisable to plant catch crops, which are plowed under in the autumn, instead of allowing the land to lie fallow. By this means the nitrates stored up in the soil are transformed into organic compounds which during the succeeding winter are gradually rendered available. At the same time the growth of the catch crops tends to check percolation and reduce nitrification by diminishing the supply of moisture in the soil and increasing the temperature. For this purpose leguminous plants are especially valuable if there is sufficient time for their growth, because they increase the supply of nitrogenous matter in the soil. For short periods, a quick-growing plant, such as white mustard, should be selected.

The growth of catch crops is especially necessary when the fallow extends over a whole year, or from summer to the following spring, the climate wet, and the soil permeable and thoroughly wet at the beginning. When, however, the water of the soil has been exhausted by the preceding crop, and the fallow is to continue only until the following autumn, the methods outlined seem not only superfluous but may even be harmful, because in this case the principal object of fallowing, *i. e.*, collection of moisture in the soil, is not attained.

RECENT WORK IN AGRICULTURAL SCIENCE.

CHEMISTRY.

A new method of determining nitrates, C. M. VAN DEVENTER (*Ztschr. Physikal. Chem., 31 (1899), pp. 50–58, figs. 2; abs. in Chem. Centbl., 1900, I, No. 4, p. 265*).—The method is based upon the formation of brown solutions by the reaction between nitrates and ferrous sulphate. The determination is made as follows: To 5 cc. of the nitrate solution containing about 8 cc. of concentrated sulphuric acid add a ferrous sulphate solution of known strength, with careful exclusion of air, until the brown coloration no longer disappears on shaking. Add 8 cc. more of sulphuric acid and ferrous sulphate in small amounts until the solution becomes red brown, ascertaining the end of the reaction by testing with potassium ferrocyanid for an excess of ferrous sulphate. Two molecules of nitric acid oxidize 6 molecules of ferrous sulphate. An apparatus suited to the method is described.

Increasing the sensitiveness of the nitric acid reaction with diphenylamin in water examination, R. CIMMINO (*Ztschr. Analyt. Chem., 38 (1899), No. 7, pp. 429–431*).—The reaction is rendered most sensitive by the addition of a few drops of a 5 to 10 per cent hydrochloric acid solution, in which case the whole solution is colored blue, and no attention need be paid to the time of contact of the water and reagent. The reaction is sensitive in 1 part of nitric acid in 1 million of water. No other constituent in water was found to give the reaction.

The meaning of the acetyl value in fat analysis, J. LEWKOWITSCH (*Analyst, 24 (1899), Dec., pp. 319–330*).—The paper records certain precautions to be observed in the determinations, especially the necessity for avoiding the presence of carbon dioxid in the water used. It is shown that the filtration and distillation processes yield concordant results, especially in the case of oils carrying only small amounts of volatile acids. Fats carrying large proportions of fatty acids are more conveniently examined by the distillation process.

A series of analyses indicates that exposed or rancid fats have a higher acetyl value than fats in a fresh state. The acetyl value can not yet be considered a constant.—G. W. SHAW.

Detection of cotton-seed oil in oils, butter, and lard, J. WAUTERS (*Bul. Assoc. Belge Chim., 13 (1899), No. 10, pp. 404–416*).—The author reviews the Becchi test, but concludes that Halpens' reaction is preferable because it gives no red coloration with other oils, butter, lard, etc. The reaction is delicate, and allows 0.25 per cent of cotton-seed oil to be detected in a mixture. Old cotton-seed oils also respond to the reaction. It is possible, by comparison, to determine the approximate amount of cotton-seed oil in a mixture by means of this test. The test is as follows: Equal volumes of the oil in question, amyl alcohol, and carbon bisulphid containing 1 per cent of sulphur in solution, are heated in a tube in a saline bath for 10 or 15 minutes. A red or orange coloration denotes the presence of cotton-seed oil.—H. SNYDER.

An accurate and practical method of determining the fat content of cream, V. Dehlholm (*Mälkeritid., 12 (1899), No. 18, pp. 313–319*).—The author recommends diluting the cream with a weighed quantity of water sufficient to make the fat content of the mixture from 6 to 8 per cent, and then determining the fat content by the Gerber method. Comparative determinations showed the results obtained in this way to be slightly too low, the error varying with the richness of the cream, and a table for correcting the results was accordingly worked out for cream containing from 12.5 to 49 per cent of fat, and is given in the paper. The dilution with water offers no difficulty in case of thin cream; to avoid formation of foam in case of cold, rich cream, it is warmed on a water bath for 5 minutes at 69° C. prior to the dilution with water.—F. W. WOLL.

Emil Wolff's treatise on the chemical investigation of materials important in agriculture, E Haselhoff (*Emil Wolff's Anleitung zur chemischen Untersuchung landwirtschaftlich wichtiger Stoffe. Berlin: Paul Parey, 1899, 4. ed. rev., pp. X+186, figs. 17*).—A thoroughly revised edition of this well-known work. It gives methods of examination of water, soils, manures and fertilizers, ashes, feeding stuffs, milk and creamery products, eggs, seeds, etc.

Quantitative chemical analysis, N. Knight (*New York: A. S. Barnes & Co., 1899, pp. 110*).—This volume contains general suggestions on the methods of procedure in organic analysis; detailed directions for the gravimetric analysis of 15 substances; a chapter on volumetric analysis; and the analysis of drinking water. A number of tables of constants useful in calculating the results are also included. According to the author "the course marked out in these pages will constitute a sufficient basis for advanced work in organic chemistry, including the ultimate analysis of substances by combustion, and for industrial chemistry which requires quantitative methods."

Introduction to micro-chemical analysis, H. Behrens (*Anleitung zur mikrochemischen Analyse. Leipsic: L. Voss, 1899, 2. ed., pp. XI + 242, figs. 96; rev. in Oesterr. Chem. Ztg., 3 (1900), No. 3, p. 59*).

Report of the chemist, R. H. Forbes (*Arizona Sta. Rpt. 1899, pp. 228–234*).—A summary account of the work of the year in this department of the station, including examinations of sugar beets and waters (E. S. R., 11, p. 236), soils, cañaigre, etc.

Miscellaneous analyses, H. Snyder (*Minnesota Sta. Bul. 63, pp. 495–512*).—Analyses are reported of various foods, food preservatives, and feeding stuffs (see p. 883); fertilizing materials (see p. 831); and miscellaneous substances, including water for retting flax, limestone for refining beet sugar, a germicide for hog cholera, insecticides, and a weed exterminator.

Chemical department, E. F. Ladd (*North Dakota Sta. Rpt. 1898, pp. 10–21*).—This is in the main a synopsis of the work of the department, on drinking waters, wool scouring, soil, humus, feeding stuffs, vinegars, poisoning of cattle by water hemlock, a glucosid of millet hay, sugar beets and preserving eggs, previously noted in E. S. R., 10, pp. 129, 171, 181, 194; 11, pp. 214, 241, 279, 287; and on chicory, marl, and ripening of cream, already noted in E. S. R., 10, p. 715; besides a record of observations on soil temperature and moisture (see p. 823), temperature of the air, and rainfall (see p. 821).

Report of the chemist, F. T. SHUTT (*Canada Expt. Farms Rpts. 1898, pp. 123–125*).—A synopsis of the work of the year in this department.

On acidimetry, H. IMBERT and A. ASTRUC (*Compt. Rend. Acad. Sci. Paris, 130 (1900), No. 1, pp. 35–37*).

The official methods for fertilizers and feeding stuffs of the Belgian laboratories and the agricultural stations of Holland and the Grand Duchy of Luxemburg (*Ann. Sci. Agron., 1899, II, Nos. 1, pp. 159, 160; 2, pp. 161–172*).—See also E. S. R., 11, p. 104.

On the distinction between citrate-soluble phosphoric acid according to the older and more recent methods and citric-acid-soluble phosphoric acid (*Deut. Landw. Presse, 27 (1900), No. 3, p. 28*).—Brief remarks on this subject.

The separation of tungsten and molybdenum, F. IBBOTSON and H. BREARLEY (*Chem. News, 81 (1900), No. 2094, pp. 13–15*).

The determination of alkalis in spring water, E. BOHLIG (*Ztschr. Analyt. Chem., 38 (1899), No. 7, pp. 431, 432*).—A short description of methods for determining the alkalis and alkaline earths.

Silica standards for the determination of turbidity in water, G. C. WHIPPLE and D. D. JACKSON (*Tech. Quart., 12 (1899), No. 4, pp. 283–287*).

A new method for determining iron in organic substances, F. RÖHMANN and F. STEINITZ (*Ztschr. Analyt. Chem., 38 (1899), No. 7, pp. 433–435*).

Determination of sulphur in organic substances, R. HENRIQUES (*Chem. Ztg., 23 (1899), No. 81, p. 869*).

Detection of fluorin in wine, G. PARIS (*Chem. Ztg., 23 (1899), No. 67, pp. 685, 686*).—Description of methods.

Color analysis of food preparations, S. WEISSBEIN (*Farbenanalytische Untersuchungen über Nahrpräparate. Inaug. Diss., Berlin, 1899; abs. in Chem. Centbl., 1899, I, No. 20, pp. 1114, 1115; Ztschr. Untersuch. Nahr. u. Genussmtl., 3 (1900) No. 1, pp. 41, 42*).—The results are reported of the examination of a number of prepared foods by means of the Erlich-Biondi tricolor mixture, according to Posner's method.

Honey analyses, C. HOITSEMA (*Ztschr. Analyt. Chem., 38 (1899), No. 7, pp. 439–441*).—The author gives the results of analyses of 10 samples of honey of "unquestionable purity," describing the methods employed.

The estimation of albumoses and peptone, J. EFFRONT (*Bul. Soc. Chim. Paris, 3. ser., 21 (1899), No. 14, pp. 680–683; abs. in Ztschr. Untersuch. Nahr. u. Genussmtl., 3 (1900), No. 1, p. 39*).

The cleavage of carbohydrates from protein, O. WEISS (*Centbl. Physiol., 12 (1898), pp. 515, 516; abs. in Ztschr. Untersuch. Nahr. u. Genussmtl., 2 (1899), No. 12, p. 920*).—A preliminary communication.

Analytical methods for distinguishing between nitrogen of proteids and nitrogen of simpler amids or amido-acids, J. W. MALLET (*Chem. News, 80 (1899), Nos. 2080, pp. 168–171; 2081, pp. 179–182*).—This paper has been abstracted from the original source (E. S. R., 10, p. 819).

Modification of the method of Mörner and Sjöquist for determining urea or the nitrogen of urea, H. MORREIGUE (*Jour. Pharm. et Chim., 6. ser., 8 (1899), No. 5, pp. 193–197*).

The iodin number of fatty acids, A. ZEGA and R. MAJSTOROVIĆ (*Chem. Ztg., 23 (1899), No. 57, p. 597*).

On a possible source of error in the Gerber method of fat determination, M. SIEGFELD (*Molk. Ztg., 13 (1899), No. 28, pp. 433–435*).—The results of a series of experiments agree with the conclusions reached by Richmond and O'Shaughnessy (E. S. R., 11, p. 213) that in the Gerber test the sulphuric acid, milk, and amyl alcohol should be added in the order named.

On the detection of margarin, H. Bremer (*Milch Ztg., 28 (1899), No. 49, pp. 769–771*).—The literature on tests for margarin is reviewed and the reliability of the sesame-oil reaction discussed.

Examination of cotton-seed oil for adulteration with maize oil, G. Morpurgo and A. Götze (*Oesterr. Chem. Ztg., 3 (1900), No. 3, pp. 53, 54*).

On the constitution of starch, I, W. Syniewski (*Liebig's Ann. Chem., 309 (1899), p. 282; abs. in Chem. Ztg., 23 (1899), No. 96, Repert., p. 348*).—In this number the author summarizes the previous investigations on different kinds of starch.

On a crystallized fibrin, L. Maillard (*Compt. Rend. Acad. Sci. Paris, 130 (1900), No. 4, pp. 192–194*).

Observations on the work of Bode and Kohl on chlorophyll, L. Marchlewski (*Jour. Prakt. Chem., n. ser., 61 (1900), No. 1, pp. 47–63*).

"Perezol," a new indicator, M. Duyk (*Bul. Assoc. Belge Chim., 13 (1899) No. 11, pp. 461–466*).—The origin of this compound, the color which it produces with alkalis, and its merits as an indicator are discussed. Its solubility in fatty bodies gives it certain advantages over other indicators in the determination of fatty acids and in general food investigations.—H. Snyder.

An improved Soxhlet reflux condenser of glass, C. Kob & Co. (*Ztschr. Analyt. Chem., 38 (1899), No. 7, pp. 442, 443, fig. 1*).—The cooler consists of 3 concentric bulbs, the outer and inner being connected with running water, and the condensation of the ether taking place in the space between these two.

BOTANY.

The structure of the cells of vessels, W. Rothert (*Bul. Internat. Acad. Sci. Cracovie, 1899, pp. 15–53, pls. 2, figs. 7; abs. in Jour. Roy. Micros. Soc. [London], 1899, No. 3, pp. 292, 293*).—The author claims that the ordinary classification of vessels into spiral, annular, reticular, and those with bordered pits is founded on an erroneous view as to their origin. The essential structure of the membrane is the same for all vessels and all are characterized by the presence of bordered pits. The author classifies them under 2 principal heads, according as they are extensible or not. The first kind, which includes annular and spiral vessels, are characterized by the thin parts of the wall running continuously around the vessel while the thicker parts are not connected longitudinally. Hence the membrane is capable of longitudinal stretching and, under certain circumstances, the thickened portion may become detached. In the second group the thin portions of the membrane are not continuous, while the thickened parts are connected in all directions into a network. The author insists that there is uniformity in the physiological purpose of all kinds of vessels. The thin portions permit the passage of water between the vessels and the surrounding elements, while the thickened portions enable them to resist radial pressure.

The chemical energy of living cells, O. Loew (*Die chemische Energie der lebenden Zellen. Munich, 1899, pp. 175; abs. in Jour. Roy. Micros. Soc. [London], 1899, No. 5, p. 498*).—In this work the author discusses the energy of living protoplasm, giving the result of a large number of his observations. The present volume treats of the causes of vital activity, the general characteristics of living substance, its chemico-physiological characteristics, the essential accompaniments of protoplasm, the character of bio-chemical work,. the formation of albumin in the lower fungi and in chlorophyllous plants, the theory of the formation of albumin, a transient protein substance as a reserve-substance in plants, the chemical characteristics of proto-protein, the motility and activity in protoplasm, and the theory of respiration. It is stated that the motility of protoplasm is brought about by the concurrence of aldehyde and amid groups, and that the oxydases can not be regarded as the source of respiration.

Absorption of solutions by the stems of plants, E. BRÉAL (*Ann. Agron., 25 (1899), No. 10, pp. 449-458*).—By means of capillary tubes thrust into the stems and leaves of maize, white lupines, chestnut, willow, amaranths, and Jerusalem artichokes, the author has sought to ascertain the possibility of the absorption of manganese nitrate and sulphate, nitric acid, ammonium nitrate and sulphate, and potassium humate.

It was found that these substances could be absorbed at the pleasure of the investigator. Manganese was readily absorbed by plants which were formerly without trace of it as was shown by the incineration of leaves and branches. Nitric acid in the form of nitrates was taken up by the stem of maize. Ammonium sulphate was taken up by the same plant, but not in a sufficient amount for quantitative determination. The nitric acid accumulated in the tissue of the maize as reserve material, while ammonia was transformed as soon as it entered the plant. Ammonium carbonate was absorbed by the leaves of hollyhocks and the stems of artichokes. Willow and chestnut leaves, previously without a trace of nitrates, absorbed considerable quantities of nitrates. Amaranths, already containing a large quantity of nitrate, greatly increased their content during the experiment. Potassium humate was taken up by lupines and was optically apparent in the woody tissues as well as in the intercellular spaces. In the experiments with maize, the entrance of humic acid was accompanied by the disappearance of nitric acid. In the experiments with amaranths, there was a reduction of nitric acid when humic acid was present, but not a total disappearance. The combination of humic and nitric acids in lupines resulted in an appreciable increase in the dry matter of the plants.

The influence of light on the growth of clover, A. PAGNOUL (*Ann. Agron., 25 (1899), No. 8, pp. 353-356*).—The growth and transpiration of crimson clover as affected by strong light and shade were investigated by means of a balance provided with a Richard register. Equal lots of seed were grown in pots containing the same amount and kind of soil, the only difference being in the amount of light. A short distance above one pot a black shade was suspended in such a way as to intercept all solar rays and maintain the plant in semidarkness without in any way interfering with the free exchange of air. The plants were always kept in a humid atmosphere and the transpiration from the well-lighted plants was always in excess of that from shaded plants. Their growth was strikingly unlike. The well-lighted plants were strong and their leaflets hairy, while the others were weak, long petioled, and smooth. At irregular intervals 100 plants were taken from each lot, dried, and analyzed, with marked differences in dry matter in favor of the plants grown in the unimpeded light. The nitric nitrogen per hundred grams of dry matter was greater in the shaded plants, showing that the nitrates accumulated in the shaded plants on account of the inability to assimilate them and, as a consequence, their development was retarded. In the plants grown under the direct action of the solar rays, nitric nitrogen was present in an appreciable quantity at the beginning of the experiment, but after about a month all trace of it had disappeared.

The author concludes that nitrates are reduced in the leaves under the action of the sun, and furnish the necessary nitrogen for the formation of albuminoid principles required by the plant.

Soil inoculation for the growth of legumes, F. T. SHUTT (*Canada Expt. Farms Rpts. 1898, pp. 137-142*).—An account is given of pot and plat experiments with peas, beans, and clover to test the value of Nitragin as an inoculation material.

In the pot experiments with peas, the author again arrived at the conclusion expressed in a previous report (E. S. R., 10, p. 845), that the larger amount of nitrogen in the treated crop is due to the greater development of root or foliage, or both, under the stimulating effect of micro-organisms furnished by the preparation.

In the case of the horse bean experiments, the largest yield was obtained from the soil-inoculated plants, and the smallest from the plats where the seed had been inoculated.

In the plat experiments the crop of clover from inoculated seed was much more luxuriant than that from the untreated seed, and, as shown by the tables, the yield was considerably heavier. With horse beans and peas in pots, the results were not so encouraging.

Summarizing the results of the year's work with Nitragin, the author states that on the whole the experiments confirm the previous results and furnish further evidence of the usefulness of this agent in fostering the growth of leguminous plants.

The real meaning of plant acclimatization, V. POLOVTSEV (*Selsk. Khoz. i Lyesov., 194 (1899), Sept., pp. 477-492*).—The term acclimatization is often misunderstood and misapplied. According to the author, by the acclimatization of a plant is understood its complete adaptation to new conditions, brought about by corresponding changes in its organization. Moreover, acclimatization can be considered as complete only in those cases where the introduced plant proves capable of completing under the new climatic conditions its full cycle of development, *i. e.*, not only of maintaining its own existence but of reproducing vigorous descendants. Such requirements, it is claimed, are very rarely fulfilled. For example, cucumbers, watermelons, and cantaloupes whose home is southern Asia and northern Africa, and which have been for a very long time cultivated in Europe, reach full maturity and produce healthy seed, but only with the aid of man. When left to themselves they invariably perish, the fruit rotting away in a rainy fall, and the occasional spring sprouts are killed by the frosts.

In the case of "naturalized" plants, although often coming from distant regions, they are introduced into countries with climatic conditions similar to those of their native land.

Real artificial acclimatization is a very rare thing. In most cases reported of the rapid acclimatization of a plant one of two things has taken place, either the plant has been naturalized or its acclimatization is not complete, the newly introduced plant not being capable of producing vigorous offspring.

Artificial acclimatization is only possible within very narrow limits. All that can be accomplished is to move a plant a little way beyond its climatic boundary, to somewhat lengthen or shorten the period of vegetation of an annual plant, or to adapt a plant from a more humid climate to a drier one, and conversely. This can be achieved only by means of the gradual, careful, and more or less protracted selection of the more enduring individuals.—P. FIREMAN.

Department of botany, H. L. BOLLEY (*North Dakota Sta. Rpt. 1898, pp. 24–28*).—The lines of work carried on by the botanical department of this station embrace investigations of rusts and smuts of cereal grains, studies of the native flora of the State, bacteriological investigations of the relationship of typhoid fever to the dairy industry, and miscellaneous histological and mycological studies pertaining to the determination of the relationship of certain parasites to their hosts.

Ferns and flowering plants of South Dakota, D. A. SAUNDERS (*South Dakota Sta. Bul. 64, pp. 101–227*).—This catalogue of species is based upon specimens in the college herbarium and on notes made by the author and the former botanist of the station, T. A. Williams.

Recent observations on Amphicarpæa monoica, ADELINE F. SCHIVELY (*Contrib. Bot. Lab. Univ. Pennsylvania, 2 (1898), No. 1, pp. 20–30*).—The present paper continues previous observations on the life history of this plant, in which the relation between the normal and cleistogamic flowers is studied.

Observations on Conopholis americana, LUCY L. W. WILSON (*Contrib. Bot. Lab. Univ. Pennsylvania, 2 (1898), No. 1, pp. 1–19, pls. 6*).—This interesting plant, the author states, is parasitic on the oak, and often forms a fringe of growth around the trunk for a distance of 10 ft. or. more. It first attacks young roots and usually starves the portion beyond the point of infection. It is perennial to the extent of living at least 8 or 10 years. The union between the parasite and host is said to be an extremely intimate one, the parasite being practically developed within the host, which rises up and incloses it after germination. The irritant action of the parasite causes the swelling of the host root and the enormous multiplication of its sclerenchyma. Numerous other points of interest in the anatomy of the plant are discussed.

Observations on some hybrids between Drosera filiformis and D. intermedia, J. M. MACFARLANE (*Contrib. Bot. Lab. Univ. Pennsylvania, 2 (1898), No. 1, pp. 87–99, pl. 1*).

Grass garden, T. W. KIRK (*New Zealand Dept. Agr. Rpt. 1899, pp. 209–214*).—A report is given of the condition of a grass garden in which a large number of native grasses are compared. The different species, to the number of about 100, are briefly commented upon, and it is the expectation of the author to give an illustrated report of those which appear to be the most valuable.

Statistical information concerning the production of fruits and seeds in certain plants, J. W. HARSHBERGER (*Contrib. Bot. Lab. Univ. Pennsylvania, 2 (1898), No. 1, pp. 100–109*).—The author has reported observations made upon quite a number of plants to determine the relative ratio between the perfect and abortive seeds and fruits, in order that some idea might be obtained as to the success of pollination and fertilization.

The plants reported upon are Indian turnip, pinxter flower, flowering dogwood, American bladder nut, *Hibiscus moscheutos*, *Xanthium canadense*, *Yucca filamentosa*, and *Pimpinella integerrima*.

From the tabular statements given, it appears that in a number of instances the number of abortive seeds and fruits greatly exceeded the perfect ones.

Water storage and conduction in Senecio præcox, J. W. HARSHBERGER (*Contrib. Bot. Lab. Univ. Pennsylvania, 2 (1898), No. 1, pp. 31–40, pls. 2, fig. 1*).—This plant, which is abundant in the valley of Mexico, is protected from rapid transpiration in a rather unusual manner. The bark of the plant consists of tabular cells arranged in a number of layers outside the cortex. Prominent in the cortex are found reservoirs filled with a balsam-like fluid which hardens upon exposure to the air. When a stem is cut or injured this liquid exudes, hardens, and thus closes the wound. The structure of the pith of the plant is figured and described, from which it appears that the water-storage reservoirs of the plant are in this region.

Observations on the development of some embryo sacs, R. E. B. MCKENNEY (*Contrib. Bot. Lab. Univ. Pennsylvania, 2 (1898), No. 1, pp. 80–86, pl. 1*).

Structure and development of the internal phlœm in Gelsemium sempervirens, CAROLINE B. THOMPSON (*Contrib. Bot. Lab. Univ. Pennsylvania, 2 (1898), No. 1, pp. 41–54, pl. 1, fig. 1*).

The structure of the cork tissues in roots of some rosaceous genera, MARTHA BUNTING (*Contrib. Bot. Lab. Univ. Pennsylvania, 2 (1898), No. 1, pp. 54–65, pl. 1*).

Comparative studies on the rate of circumnutation of some flowering plants, ELIZABETH A. SIMONS (*Contrib. Bot. Lab. Univ. Pennsylvania, 2 (1898), No. 1, pp. 66–79*).

On the distribution and biological importance of furfuroids in the soil, J. STOKLASA (*Sitzber. Math. Naturw. Cl. K. Akad. Wiss. [Vienna], 107 (1898), No. 8, pp. 966–976*).—Furfuroids in the soil are essential to the development of the bacteria concerned in nitrogen assimilation.

METEOROLOGY—CLIMATOLOGY.

Monthly Weather Review (*U. S. Dept. Agr., Weather Bureau, Monthly Weather Review, 27 (1899), Nos. 10, pp. 449–502, pl. 1, figs. 3, charts 9; 11, pp. 503–533, charts 9; 12, pp. 535–575, fig. 1, charts 10*).—In addition to the usual reports on forecasts, warnings, weather and crop conditions, meteorological tables and charts, No. 10 contains special contributions on Effect of wind on catch of rainfall, by G. J. Symons; Description of a new brass river gauge at Richmond, Va., and its method of support, by O. D. Leisenring; The climate of St.

Lawrence Island, by A. J. Henry; The sluggishness of thermometers (illus.), by C. F. Marvin, and Serpentine lightning, by J. W. Kales; and notes by the editor on the rain gauge and the wind, meteorology by the laboratory method, the recurving of hurricane tracks in the North Atlantic, meteorology in the schools, replies to correspondents regarding thunderstorms, tornadoes, and danger from lightning, the baguios of the Philippines, the Ben Nevis observatory, the Seventh International Geographical Congress, The Weather Review and the high schools, heat radiation of the stars, the first volume of the Maryland Weather Service, the director of the Iowa Weather and Crop Service, rainfall and rivers in Idaho, irrigation by wire, auroras in Texas, frosts and strawberry crop, warm rains and angleworms, this year's crop and last year's growing season, protection against frost, the weather and the dairy, losses by lightning, vapor pressure for water and ice, and temperature and moisture of soils in Red River Valley.

No. 11 is confined to the usual reports, with no special articles.

No. 12 contains special contributions on Ratio of the discharges of the Chagres River at Gamboa and Bohio to the rainfall in the watershed above these places (illus.), by H. L. Abbott; Comparative rain gauge readings at Atlanta, Ga., by A. J. Henry, and Date of cold Friday, by A. J. Henry; and notes by the editor on history of the barometer, "tule fog," the "Gran Cultura" in Puerto Rico, scientific assistants, barometric corrections and reductions, meteorology in the universities, and meteorological observations at public schools.

Meteorological observations, C. S. PHELPS (*Connecticut Storrs Sta. Rpt. 1898, pp. 213–215*).—A record is given of observations on temperature, pressure, humidity, precipitation, cloudiness, and wind movement during each month of 1898 at Storrs, and on rainfall during the 6 months ended October 31, 1898, at 21 points in Connecticut. The mean temperature at Storrs for the year was 48° F.; mean pressure, 30.04 in.; total rainfall, 51.13 in.; number of cloudy days, 128. The average rainfall for the State during the 6 months ended October 31 was 29.54 in. The rainfall was 5.3 in. above the average at Storrs for the past 10 years, and about 3 in. above the general average for Connecticut. It was fairly well distributed throughout the year. The temperature for April and May was unusually low. The last killing frost occurred on May 10. The summer was unusually warm and the weather conditions were favorable for nearly all crops.

Work at the station of agricultural climatology of Juvisy during the year 1898, C. FLAMMARION (*Bul.* [*Min. Agr. France*], *18 (1899), No. 3, pp. 150–169, pls. 7, figs. 7*).—The work here reported, which was mainly a continuation of that of previous years (E. S. R., 10, p. 613) included observations on temperature of the air and of the soil at different depths, atmospheric pressure, solar radiation, rainfall, underground water, and photography of atmospheric phenomena.

The temperature for each day of 1898 is reported, as well as the means for 14 years (1885–1898). The results are platted for the year and for the seasons and discussed in some detail. The mean temperature for the year 1898 was 10.7° C.

The observations on the temperature of the soil were of the same character as those of previous years and gave similar results.

Observations on solar radiation were continued with the form of actinometer described in the previous report (E. S. R., 9, p. 616). The results are given in tables and diagrams. The sunshine recorded was 1,540 hours and 45 minutes; the calories, 123,269.

The rainfall was 539.1 mm. in 1898. A diagram shows the rainfall at Paris since 1690. The temperature of the rainfall was also taken and compared with that of the air. The temperature of the rain was uniformly lower than that of the air. The number of days on which rain fell was 136.

The observations on underground water and the results obtained were of the same nature as those recorded in 1897. The results of work on cloud photography are reported with some excellent reproductions of cloud photographs.

The diagrams accompanying this report are very ingenious and instructive.

Studies of the atmosphere by means of meteorological instruments carried by kites, L. TEISSERENC DE BORT (*Compt. Rend. Acad. Sci. Paris, 129 (1899), No. 2, pp. 131, 132*).—A brief account is given of observations made at Trappes in 1897, 1898, and 1899. By means of Hargrave kites observations were made at heights of over 3,000 meters. It was observed that with clear weather and high pressure the force of the wind decreased with the altitude up to a height of 1,500 to 3,000 meters, but that the opposite was true when the weather was cloudy and the pressure low. Within certain limits of altitude the temperature fell very slowly and sometimes increased with the altitude in zones of high pressure. In zones of low pressure the fall in temperature was more rapid.

Meteorological observations, W. F. ELLIS, R. ROBERTSON, and A. MACKAY (*Canada Expt. Farms Rpts. 1898, pp. 72, 241, 242, 373*).—Summaries of observations on temperature, sunshine, and precipitation at the Central Experimental Farm at Ottawa for each month of 1898; general notes on the weather and a monthly summary of observations on temperature for the year ended November 30, 1898, at Nappan, Nova Scotia; and a monthly summary of observations at Indian Head, Northwest Territories, on temperature, sunshine, and precipitation during the year ended November 30, 1898.

Summary of meteorological observations, 1899 (*Colonia, 5 (1899), No. 6, p. 357*).—This is a monthly summary of observations on temperature, rainfall, sunshine, and direction of the wind made at Colonial College, Hollesley Bay, Suffolk, England.

Meteorological summary for 1898 (*Maryland Sta. Rpt. 1899, p. VII*).—A monthly summary of observations on temperature and precipitation. The highest temperature was 105° F., July 2; the lowest, 4°, Dec. 15; the mean, 50.2°. The total annual precipitation was 35.24 in.

Meteorological report, J. S. Moore (*Mississippi Sta. Rpt. 1898, pp. 10, 11*).—This is a summary of the monthly precipitation during 1897 and 1898, with an average for 10 years. The relation of the distribution of the rainfall to the growth of crops during 1897 and 1898 is briefly discussed.

Some studies in meteorology, E. F. Ladd (*North Dakota Sta. Rpt. 1898, pp. 13-18, 20*).—Monthly summaries of observations on temperature and rainfall for 7 years (1892-1898). The average rainfall at Fargo for 7 years was 19.72 in.

Meteorology of the year 1899 (*Rev. Sci.* [*Paris*], *4. ser., 13 (1900), No. 4, pp. 119-121*).—Observations made in France and other parts of Europe and in North Africa are summarized and discussed.

The station of agricultural climatology at Juvisy, 1894, C. Flammarion (*Ann. Sci. Agron., 1899, II, No. 1, pp. 1-37, figs. 16*).

The movements of the air, E. Less (*Noted in Rev. Sci.* [*Paris*], *4. ser., 12 (1899), No. 23, p. 729*).

Explosions to prevent hailstorms, J. Dufour (*Chron. Agr. Canton Vaud, 13 (1900), No. 1, pp. 1-12, figs. 2*).—A more complete account of what purport to be successful experiments in Styria, briefly noted in E. S. R., 11, p. 323, with descriptions of the apparatus and methods used.

Protection against tornadoes, H. A. Hazen (*Amer. Agr. (mid. ed.), 65 (1900), No. 3, p. 68*).

Frost warnings and protection, J. W. Smith (*Amer. Agr. (mid. ed.), 65 (1900), No. 3, p. 82*).—An address delivered before the Ohio Board of Agriculture, January, 1900.

Climate and plant growth in Argentina (*Mitt. Deut. Landw. Gesell., 14 (1899), No. 20, Sup., pp. 113-120; No. 21, Sup., pp. 124-128*).

Kite meteograph construction and operation (*Sci. Amer. Sup., 49 (1900), No. 1258, pp. 20166, 20167, figs. 4*).

WATER—SOILS.

A study of the phosphoric acid dissolved in the soil water, T. Schloesing (*Ann. Sci. Agron., 1899, I, Nos. 2, pp. 316-320; 3, pp. 321-359, figs. 8*).—A detailed account of investigations briefly reported elsewhere (E. S. R., 10, p. 714). Examinations were made of 8 good soils of very different character. In all of these the phosphates, although very slightly soluble, were nevertheless dissolved in small proportions in water, the amount so dissolved varying from 0.1 to 3 mg. per liter, but was remarkably constant for one and the same soil. It was found that the proportion of phosphoric acid soluble in water remained comparatively constant in spite of the fact that considerable amounts were withdrawn by the roots of plants. On the basis of experiments with a variety of crops grown in pots it is estimated that during the 25 or 30 weeks of the growing period the soils furnished in this way from 10 to 30 kg. of phosphoric acid per hectare. It thus appears that while the amount of phosphoric acid present in the soil water at any given time is comparatively insignificant, the total amount which may thus be furnished to plants during the growing period becomes a factor of first importance.

On the solubility of the phosphoric acid in the surface soil and subsoil, J. SEISSL (*Ztschr. Landw. Versuchw. Oesterr., 2 (1899), pp. 120–124; abs. in Chem. Centbl., 1899, II, No. 21, p. 1136; Chem. Ztg., 23 (1899), No. 40, Repert., p. 149*).—The results of examinations of 12 samples of soil (surface and subsoil) for total phosphoric acid and sesquioxids and citric-acid-soluble phosphoric acid are reported. The results show that the relation between phosphoric acid and sesquioxids was much closer in the surface soils than in the subsoils and that the phosphoric acid of the former was more soluble than that of the latter. The citrate solubility is very largely determined by the amounts of sesquioxids and organic matter present, but the lime content also undoubtedly exerts an influence in this respect.

What percentage of phosphoric acid should a good soil contain? A. PAGNOUL (*Ann. Agron., 25 (1899), No. 11, pp. 519–557, fig. 1*).—The author reports pot experiments with crimson clover on 2 soils (each a mixture of a number of soils), 1 of which contained 89 mg. of total phosphoric acid and 0.13 mg. of assimilable phosphoric acid, and the other 160.5 mg. total phosphoric acid and 6.18 mg. of assimilable phosphoric acid per 100 gm. of soil. One pot of each soil (6 kg.) received no fertilizer, while one received 3 gm. of superphosphate. From a study of the weight and composition of the crops obtained the author concludes that for clover at least the commonly accepted limit of 0.1 per cent of phosphoric acid in soils is too low and should be raised to from 0.15 to 0.2 per cent. The question, however, demands further study.

The method employed by the author in examining soils for available phosphoric acid is as follows: Treat an amount equal to 10 gm. of dry soil for 2 hours with 10 cc. (diluted to 50 cc.) of a solution of acetic acid prepared by dissolving 120 gm. of crystallized acetic acid in 1 liter of water, a sufficient additional quantity of the acetic acid solution being added to neutralize the lime present in the soil, and the solution shaken 10 times during the process. Use 25 cc. of the filtered solution, corresponding to 5 gm. of the soil, for the determination of phosphoric acid. For this purpose the author uses a colorimetric method which requires the following solutions: (1) A solution of 100 cc. of ordinary ammonia diluted to 1 liter; (2) 70 to 80 cc. of sulphuric acid diluted to 1 liter; (3) a 10 per cent solution of potassium ferrocyanid; and (4) a type solution of phospho-molybdate containing 4 mg. of phosphoric acid per liter, prepared as follows: A solution of sodium or ammonium phosphate containing exactly 4 mg. of phosphoric acid is precipitated in the form of phospho-molybdate, the precipitate washed on a filter to remove all excess of ammonium molybdate, and then dissolved in the ammonia solution above described, the volume being made up to 1 liter with the same solution. The determination of phosphoric acid in soil is made by dissolving the precipitate obtained from 25 cc. of the acetic-acid solution in the ammonia solution and comparing the color with that of the type solution of phospho-molybdate.

Soil temperature and moisture, E. F. LADD (*North Dakota Sta. Rpt. 1898, pp. 14–18, 20, 21*).—This is a record of observations on soil temperature at depths of 1 to 84 in. during the period from May, 1892, to December, 1898, inclusive, and on soil moisture as determined weekly in a cultivated field at the college during May–October for 5 years (1892–1896). From data obtained during 1893–1897 it appears that the frost lines in an open field at Fargo was between 4 and 5 ft. As a rule the frost was found to be out of the ground by May 20.

The mean monthly temperatures at different depths during 7 years (1892–1898) are shown in the following table:

Mean monthly temperatures for 7 years (1892–1898).

Month.	1 inch.	3 inches.	6 inches.	12 inches.	24 inches.	48 inches.	60 inches.	84 inches.
	Degrees.	*Degrees.*	*Degrees.*	*Degrees.*	*Degrees.*	*Degrees.*	*Degrees.*	*Degrees.*
May	56.6	50.8	46.8	43.9	38.7	34.3	33.7	34.8
June	67.0	61.9	58.8	57.6	51.0	44.0	40.9	38.0
July	74.1	67.9	65.2	63.6	59.3	53.1	49.1	43.7
August	75.6	66.2	64.5	63.5	61.0	56.0	52.9	47.4
September	67.1	60.4	57.5	58.4	57.8	55.7	53.9	49.6
October	48.6	45.8	46.2	48.5	49.8	51.3	51.2	49.5

"An inspection of the above table shows the 1 in. thermometer to give the highest record in August, while the soil at 3, 6, and 12 in. reaches its maximum temperature in July, the soil at 24 and 48 in. reaches an average maximum in August the same as for the surface soil at 1 in. in depth, while the soils at a depth of 60 and 84 in. continued to grow warmer and reached their maximum temperature in September."

Soil temperatures at Fargo are compared with those observed at Geneva, N. Y. In connection with the record of the amounts of water in the soil during the growing period the yields of various crops on the soil are reported.

Notes on alkali soil in Montana, F. W. TRAPHAGEN and W. M. COBLEIGH (*Jour. Amer. Chem. Soc., 21 (1899), No. 9, pp. 753–757*).—Analyses of typical alkali soils of the Yellowstone Valley are reported for the purpose of showing the kinds of salts usually present, their relative proportions, and their movement in the soil under irrigation. (See also E. S. R., 11, p. 223). The alkali of Montana is almost entirely of the "white" variety.

"With the advent of irrigation, the salts, usually deeply located, begin to rise to the surface. The water table, formerly many feet deep, approaches nearer and nearer to the surface, and of course brings the soluble salts with it. . . .

"The best method for combating the evil would appear to be underdrainage, but land is so cheap that the expense of such a remedy could not be met. Careful surface flooding, economical use of water and intelligent cropping, are the remedies in the hands of the farmer, and properly employed will solve the problem."

Analysis of eastern province soils, C. F. JURITZ (*Agr. Jour. Cape Good Hope, 15 (1899), No. 11, pp. 695–711*).—This is a report of analyses (with descriptions of samples) of 27 samples of soils from Komgha Division, 28 from the Cathcart Division, and 4 from Queenstown Division, of the Province of Cape of Good Hope. This is a continuation of the soil survey of the colony, partial reports of which have already been noted (E. S. R., 11, p. 328). The average composition of the soils examined is as follows:

Average composition of eastern Cape of Good Hope soils.

	Number of analyses.	Fine earth.	In fine earth. Lime.	Potash.	Phosphoric acid.	Nitrogen.[a]
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Komgha	27	97.0	0.126	0.061	0.027	0.182
Cathcart	28	94.3	.165	.109	.042	.101
Queenstown	4	93.8	.280	.171	.028	.100

[a] In soil passing 1 mm. sieve.

"Taken all round there is a fair amount of lime and potash in the soils of both divisions [Komgha and Cathcart], but they are decidedly poor in phosphates."

Analysis of Transkei soils, C. F. Juritz (*Agr. Jour. Cape Good Hope, 15 (1899), No. 12, pp. 777–781*).—Samples of 16 soils from the Butterworth, Willowvale, and St. Mark's divisions of the Colony are described and analyses of them reported. This work was done in continuation of the soil survey of the Colony, partial reports of which have already been noted (see above). The average composition of the soils is as follows:

Average composition of western Cape of Good Hope soils.

	Number of analyses.	Fine earth.	In fine earth Lime.	Potash	Phosphoric acid.	Nitrogen.[a]
		Per cent	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Butterworth	8	93 22	0.107	0 088	0.028	0.166
Willowvale	4	98.57	.041	.159	.045	.158
St. Mark's	4	81 46	.063	.084	.024	.096

[a] In soil passing 1 mm. sieve.

These soils as well as those of other parts of the Colony are especially deficient in phosphoric acid. Some of them are also poor in lime, and potash is present in only fair amounts.

The amount of humus in soils and the percentage of nitrogen in the humus as affected by applications of air-slaked lime and certain other substances, H. J. Wheeler, C. L. Sargent, and B. L. Hartwell (*Jour. Amer. Chem. Soc., 21 (1899), No. 11, pp. 1032–1037*).—This question was studied in experiments with pots filled with soil and subsoil from the experimental plats of the station.

"The pots employed were galvanized iron ash cans about 26 in. deep and 18 in. in diameter, with bottoms inclined toward the center, at which point an opening was left to insure drainage. The pots were set into the soil to within 2 in. of the tops and agricultural drain tiles laid underneath, to prevent the ingress of surrounding soil water. One hundred and fifty-four pounds of subsoil and 100 pounds of surface soil were placed in each pot. The pots were filled in the spring of 1893. In 1893 and 1894 each manured pot received 7.36 gm. of potassium chlorid and 22.07 gm. of dissolved boneblack. In the succeeding years these amounts were increased to 10 and 25 gm., respectively. Wherever nitrogen was applied it was at the rate of 2.65 gm. per pot. Lime, unless otherwise specified, was applied in the form of air-slaked lime, practically free from magnesia, at the rate of 147.2 gm. per pot (4 tons per acre). Gypsum was applied so as to furnish the same amount of calcium oxid as the air-slaked lime at the rate of 4 tons per acre. Rhode Island capped corn (maize) was grown in the pots in 1893, oats in 1894, and spring rye in 1895."

Samples of soil taken after harvesting the rye were examined for humus by treatment with hydrochloric acid according to Hilgard, and with ammonia by Huston and McBride's method. Nitrogen in humus was determined by the Kjeldahl method in the extract obtained by treating the soil with a 2.5 per cent solution of potassium hydroxid. The results were as follows:

Humus and humus nitrogen in limed and unlimed soils differently manured.

Numbers of pots.	Manures applied. *a*	Humus nitrogen in dry soil.	Humus in dry soil.	Nitrogen in dry humus.
		Per cent.	*Per cent.*	*Per cent.*
21	Unmanured	0.130	3.86	3.37
16, 18, 25	Ammonium sulphate	.128	3.93	3.26
15, 22	Ammonium sulphate, air-slaked lime (1 ton per acre)	.133	3.77	3.53
17, 19, 26	Ammonium sulphate, air-slaked lime (4 tons per acre)	.126	3.63	3.47
1, 8	Ammonium sulphate, calcium sulphate (land plaster) at a rate equivalent in CaO to 4 tons of air-slaked lime per acre	.139	3.65	3.81
20, 27	Without nitrogen and lime	.129	3.75	3.44
23, 24	Air-slaked lime (4 tons per acre)	.139	3.51	3.68
6, 13	Sodium nitrate	.143	3.93	3.64
7, 14	Sodium nitrate and air-slaked lime (4 tons per acre)	.183	3.42	3.89

a All of the pots except No. 21 received like amounts of potash and phosphoric acid.

"From the foregoing it will be seen that without exception the addition of air-slaked lime or gypsum resulted in lowering the total amount of humus, as compared with the unmanured plat, yet in every instance the percentage of nitrogen in the humus had been increased. In fact the latter statement applies also even where no nitrogen was added (pots 23 and 24).

"Where lime was not applied, but nitrogen was employed in form of ammonium sulphate, which in the acid soil proved poisonous to plants (pots 16, 18, and 25), it will be observed that the percentage of nitrogen in the humus was even less than where no manure was used (pot 21). On the contrary, where nitrogen in the form of sodium nitrate was added without lime (pots 6 and 13), the percentage of nitrogen in the humus was greater than in the case of the unmanured soil (pot 21).

"It is also of special interest to observe that in the case of the unlimed soil, which received potash and phosphoric acid but no nitrogen (pots 20 and 27), the percentage of humus became less than in the unmanured soil, while, on the contrary, where nitrogen was applied as sodium nitrate and as ammonium sulphate to unlimed soil, it is possible that a slight increase in the percentage of humus resulted. The differences are not great enough, however, to furnish any positive evidence in this respect."

It is suggested that the increase of humus and humus nitrogen in the soils to which nitrate of soda was added was due to "a storage of some of the nitrate nitrogen within the soil in the form of organic matter, which becomes quickly soluble in ammonium hydroxid, or, in other words, passes largely into a condition which permits of its classification with that organic complex which is termed humus."

Well waters from farm homesteads, F. T. SHUTT (*Canada Expt. Farms Rpts. 1898, pp. 161-165*).—This is a report of analyses with reference to sanitary condition of 75 samples of well water from different parts of the Dominion of Canada, with suggestions as to means of securing a pure water supply on the farm.

Sterilization of drinking water by heat, DESMAROUX (*Stérilisation des eaux d'alimentation par chaleur. Paris: J. B. Baillière & Sons, 1898, pp. 172*).

Irrigation and drainage, F. H. KING (*New York: The Macmillan Co., 1899, pp. XXI+502, figs. 163*).—This book is one of the Rural Science Series, edited by L. H. Bailey. The subjects are discussed from the purely cultural standpoint, and not from that of the engineer, the aim being "to deal with those relations of water to soils and to plants which must be grasped in order to permit a rational practice of applying, removing, or conserving soil moisture in crop production."

The results of the author's own experiments at the Wisconsin Experiment Station, and of his inspection of the irrigation methods of both humid and arid regions in this and in foreign countries, have been freely drawn on in the preparation of this work. It contains chapters on the following topics: General remarks on the importance of water; the extent and geographic range of irrigation; the conditions which make irrigation imperative, desirable, or unnecessary; the extent to which tillage may take the place of irrigation; the increase of yield due to irrigation in humid climates; amount and measurement of water for irrigation; frequency, amount, and measurement of water for single irrigations; character of water for irrigation; alkali lands; supplying water for irrigation; methods of applying water in irrigation; sewage irrigation; principles of drainage; practical details of underdraining. The subject of drainage is briefly treated, occupying only 78 out of the 502 pages of the book.

The value of the White Nile to Egypt, W. WILLCOCKS (*Jour. Khediv. Agr. Soc. and School Agr., 1 (1899), No. 6, pp. 225-231*).—A general discussion of this subject with special reference to the recent decision of the government to appropriate money for the purpose of clearing the sudd from the White Nile, thereby influencing the supply of water available for irrigation purposes.

Influence of forests on underground water, P. OTOTZKY (*Ann. Sci. Agron., 1899, II, No. 2, pp. 300-316, figs. 5*).—In continuation of observations made in 1895 in the steppes (E. S. R., 9, p. 1041) the author in 1897 studied the position of the underground water in forests in northern Russia, where the physico-geographical and climatic conditions are very different from those obtaining in the steppes. The same conclusion, however, was reached as in the former study, viz, that the level of the ground water was always lower in the forest than in adjacent open land.

The soil and water conditions of the province of Rhein-Hessen, of the Rheingau and Taunus, C. LUEDECKE (*Mitt. Landw. Inst. Breslau, 1899, No. 2, pp. 45-149*).—This article describes the typical soil areas of these districts, discusses their geological relations, and reports chemical and mechanical analyses of a large number of samples, with observations on the water relations and spring and underground water of the various soils studied.

Practical treatise on soils; directions for the study, classification, and charting of soils, A. NOWACKI (*Praktische Bodenkunde; Anleitung zur Untersuchung, Klassifikation und Kartierung des Bodens. Berlin: Paul Parey, 1899, 3. ed. rev. and enl., pp. VIII+190, pl. 1, figs. 9*).—This is the third edition, revised and enlarged, of this volume of the Thær-Bibliothek series, the first edition of which appeared in 1884.

Canadian soils, F. T. SHUTT (*Canada Expt. Farms Rpts. 1898, pp. 154–158*).—This includes reports of partial analyses of 1 sample each of cultivated and virgin soil from Grindstone Island, Magdalen Islands, Quebec, and of 1 sample each of soil from Pefferlaw, Township of Nepean, near Ottawa, and Port Arthur, Ontario, with suggestions as to the fertilizers to be used on these soils.

The geological significance of soil study, E. W. HILGARD (*Science, n. ser., 11 (1900), No. 267, pp. 221, 222*).—A brief note on a paper discussing the value of observations on soil areas and their characteristic vegetation as a means of delineating geological formations, and treating of the chemico-geological relations between soils and the geological formations from which they were derived through subaerial agencies.

Isolation of the organisms of nitrification from soil, V. OMELIANSKI (*Contbl. Bakt. u. Par., 2. Abt., 5 (1899), No. 15, pp. 550–561*).

Soil bacteria, VIBRANS (*Mitt. Deut. Landw. Gesell., 14 (1899), No. 20, pp. 301–303*).

FERTILIZERS.

The preservation of barnyard manure, F. T. SHUTT (*Canada Expt. Farms Rpts. 1898, pp. 126–137*).—This is a detailed account of investigations already partially reported (E. S. R., 9, p. 822). Particular attention was given to two points in these investigations: (1) a comparison of the changes occurring during the decomposition of protected and exposed manure, and (2) the effectiveness of gypsum as a preservative. In the first case, of 2 lots (4 tons each) of fresh mixed horse and cow manure with litter, alike in composition, one was placed in a closed shed, the other in an open wooden bin with a practically water-tight floor, and both lots were weighed and analyzed month by month for the period of a year. The analytical data obtained include moisture, organic matter, ash, total nitrogen, and nitrogen as ammonia, nitrates, and nitrites, total and available phosphoric acid, and total and available potash. "The amounts of total phosphoric acid and potash obtained were those dissolved out of the manure by hot, strong hydrochloric acid (sp. gr. 1.115) at the temperature of boiling water; the amounts of these constituents designated as available were obtained by treatment with dilute citric acid (1 per cent) in the cold."

From the data obtained, which are reported in full, the following conclusions are drawn:

"(1) There is a greater loss of nitrogen and organic matter from the exposed manure than from that protected. The former lost one-third of its nitrogen, the latter about one-fifth. Ten per cent more organic matter was destroyed in the exposed than in the protected manure.

"(2) There is practically no loss of potash and phosphoric acid from the protected manure.

"(3) The exposed rotting manure lost about one-sixth of its phosphoric acid and somewhat more than one-third of its potash.

"(4) The chief changes, due to fermentation, take place within the first months of rotting, and as far as this experiment goes there is no apparent benefit in rotting for a longer period than 3 months."

"[In the experiments with gypsum] three tons of horse and cow manure, mixed in equal proportions, were allowed to ferment without the addition of any preservative, and an equal weight of the same manure was mixed intimately with ground gypsum or land plaster at the rate of 50 lbs. per ton of manure. These lots were fermented at the same time in separate bins inside the small building used in the previous experiment. The manures were placed in the building on July 15, being then fresh, made as compact as possible and not stirred or otherwise disturbed till the close of the experiment, November 15, when they were again weighed and samples taken for analysis. From time to time both lots of manures were moistened. Both manures, therefore, were, with the exception of the presence of gypsum in the one, rotted under the same conditions."

The results show that the use of gypsum retarded to a certain extent the destruction of organic matter.

"With respect to nitrogen, however, no useful result was observed under the conditions of this experiment from the use of gypsum. The amounts in the manure rotted with and without plaster were practically the same. . . .

"The practical conclusions from this part of this investigation are (1) that the proper place to use gypsum is in the stable, where undoubtedly the greater waste of nitrogen, as ammonia, frequently occurs, and (2) that when the manure heap is kept compact and moist there is not any considerable escape of ammonia."

It was found in these experiments that if the manure is kept moist loss of potash can not be completely prevented without a water-tight, nonabsorbent floor.

Recent studies on the management of manure—loss of nitrogen in the free state, P. P. DEHÉRAIN and DUPONT (*Ann. Agron., 25 (1899), No. 9, pp. 401–420*).—Previous investigations by the authors and others are briefly noted, and an account is given of the changes occurring in lots of manure (372.5 to 527.5 gms.), kept for periods of 8, 22, and 49 days in 1,500 cc. flasks with and without a supply of air. The manure was analyzed at the beginning and end of the experiments and the gaseous products were also collected and analyzed.

The loss of nitrogen in the free state in these experiments varied from 4.9 to 13.4 per cent of the total nitrogen in the manure in case of aerobic fermentation, and from 4.2 to 11.1 per cent in case of anaerobic fermentation. This confirms the conclusions of Dupont[1] and Hébert (E. S. R., 4, p. 589) that manure loses nitrogen in the free state during fermentation. On the other hand, Schloesing (E. S. R., 3, p. 737) has shown that manure may be submitted to fermentation for several weeks without loss of nitrogen in the free state. The results obtained in these experiments indicate that when marsh gas fermentation is energetic there is no evolution of free nitrogen. It is suggested that the best means of promoting this kind of fermentation is to keep the manure very alkaline by frequent wetting with liquid manure. The subject is being further studied on a larger scale.

Recent experiments on the management of stable manure, F. HOLDEFLEISS (*Mitt. Landw. Inst. Breslau, 1899, No. 2, pp. 233–249*).—These experiments were made with zinc-lined wooden boxes containing from 1,580.5 to 1,782 kg. of manure. One box received no preservative, in one 32 kg. of kainit was used, to a third 31 kg. of superphosphate (containing 16 per cent of soluble phosphoric acid) was added. Great care was exercised to secure exclusion of air and uniform wetting of the manure in all cases. The manure was analyzed at the beginning and at the end of the experiment (which lasted about 5 months) with a view to determining the loss of dry matter and nitrogen. Observations were also made on temperature and evaporation. There was a decided loss of organic matter and nitrogen even with the greatest care in packing the manure, keeping it moist, and excluding air. The addition of about 2 per cent of kainit and of superphosphate reduced this loss to a minimum. The kainit was as effective as the superphosphate in preventing loss, and at the same time it allowed very active fermentation to go on, which improved the availability of the fertilizing constituents of the manure.

---

[1] Ann. Agron., 14 (1888), p. 97.

Autumn catch crops—their efficiency as green manure, P. P. DEHÉRAIN (*Compt. Rend. Acad. Sci. Paris, 129 (1899), No. 3, pp. 139–141*).—This is a discussion based on experiments at Grignon during 1897 and 1898, on the value of vetch as a catch crop to follow wheat and to be turned under as a green manure for potatoes and sugar beets. The growth of vetch varied on the different plats from the equivalent of less than 8 tons to about 16 tons of barnyard manure (with 11 lbs. of nitrogen per ton) per acre. The vetch was turned under at the end of October. All of the plats received an additional application of 12 tons of barnyard manure per acre. With both potatoes and beets the yields were largest on the plats receiving the heaviest green manuring with vetch.

These results confirm those of previous years in demonstrating the great value of autumn catch crops. It is suggested, however, that to get the best results these crops should be turned under in the autumn. If this is delayed until the spring the organic matter will not decompose sufficiently so that the following crop can utilize the nitrogen of the green manure to the best advantage.

Fertilizer inspection, C. D. WOODS and J. M. BARTLETT (*Maine Sta. Bul. 53, pp. 57–70*).—This bulletin is supplementary to Bulletin 50 of the station (E. S. R., 11, p. 137). It gives analyses of 163 samples of fertilizers collected by representatives of the station. The bulletin also includes notes on the valuation of fertilizers and a discussion of the quality of fertilizers offered for sale in Maine.

"A comparison of the results of the analyses of the samples collected by the station with the percentages guaranteed by the manufacturers shows that, while as a rule the fertilizers sold in the State are up to guarantee, in some instances the particular lots of fertilizers sampled are not as good as they should be. The comparisons indicate that many of the manufacturers do not intend to do much more than make good the minimum guarantee, and it is not surprising that this results in some of the goods falling below the guarantee in one or more ingredients."

Analyses and valuations of fertilizers, L. A. VOORHEES and J. P. STREET (*New Jersey Stas. Bul. 139, pp. 59*).—This bulletin gives trade values of fertilizing constituents in 1899 and the results of examinations of the standard commercial materials supplying them, as well as of home mixtures, factory-mixed fertilizers, and miscellaneous fertilizing materials. Analyses and valuations are given of 74 samples of standard raw materials, 321 brands of complete fertilizers, 30 samples of ground bone, 24 samples of home and special mixtures, and 23 samples of miscellaneous products. Materials examined include, in addition to the mixed fertilizers, nitrate of soda, sulphate of ammonia, dried blood, ground fish, tankage, cracklings and hoof meal, ground bone, superphosphates, muriate of potash, sulphate of potash, and kainit. The consumption of fertilizers in New Jersey in 1898 "was greater than in any previous year in which the statistics were gathered, being nearly 4,000 tons more than in 1896 and nearly double the amount reported in 1889." The number of distinct brands was greater than in any previous year except 1896. The 321 brands of which analyses are reported were the product of 90 manufacturers. The fertilizers examined furnished on the average the total amount of plant food guaranteed, but in only 69 per cent of them was it distributed in the proportion stated.

The average composition, estimated value, and selling price of all brands of complete fertilizers examined during 1899 were as follows: Total nitrogen, 2.41; total phosphoric acid, 10.58 (soluble phosphoric acid, 8.27; insoluble phosphoric acid, 2.31); potash, 5.67; station valuation, $19.95; selling price, $27.75; actual difference, $7.80; percentage difference, 39.1. Comparison of these figures with similar data for previous years (E. S. R., 10, p. 1032) shows "that notwithstanding the tendency toward furnishing less nitrogen and more phosphoric acid and potash the composition of the average fertilizer has been remarkably uniform for the past 8 years."

The average cost per pound of nitrogen in the samples (8) of nitrate of soda examined was 12.16 cts.; sulphate of ammonia (1 sample), 14.29 cts.; dried blood (5 samples), 12.91 cts.; ground fish (16 samples), 13.31 cts.; tankage (8 samples)—fine, 15.51 cts., coarse, 11.15 cts. The average cost per pound of soluble phosphoric acid in plain superphosphates (16 samples) was 3.65 cts. The cost of phosphoric acid in tankage (8 samples) was—fine, 4.46 cts., coarse, 2.23 cts. The average cost per pound of potash in muriate of potash (13 samples) was 4.03 cts.; in kainit (3 samples), 4.48 cts.; and in sulphate (1 sample), 5.27 cts.

Rules for the construction of manure pits (*Deut Landw. Presse, 27 (1900), No. 4, p. 33*).—The rules formulated by a commission of the agricultural council of Pomerania.

Poultry manure (*Queensland Agr. Jour., 6 (1900), No. 1, pp. 23–25*).—A brief summary of information on the value of this material as a fertilizer.

On nitrate-reducing bacteria, W. Krüger (*Chem. Ztg., 23 (1899), No. 80, pp. 848, 849*).—A brief reference to investigations which indicated that straw furnishes an excellent basis for a culture medium for these organisms.

A contribution to the knowledge of denitrification and the decomposition of animal manures in the soil, K. Rogoyski (*Anzeiger Akad. Wiss. Krakau, 1899, pp. 385–411*).

The decomposition of nitrates in soils in field experiments, W. SCHNEIDEWIND (*Chem. Ztg., 23 (1899), No. 80, pp. 848, 849*).—A brief reference to experiments of the same character as those noted in E. S. R., 11, p. 32. In field experiments with mustard there was a destruction or conversion into insoluble forms of 13.9 lbs. of nitric nitrogen per acre during 5 weeks following the application of 11.13 tons of fresh manure per acre. The loss was still greater when the urine or nitrate was applied in mixture with the manure.

On denitrification, T. PFEIFFER (*Chem. Ztg., 23 (1899), No. 80, p. 849*).—This is mainly a discussion of the views of Schneidewind and Krüger referred to above (p. 830). It is stated that at least three factors are involved in the injurious effects under consideration, viz, (1) direct injury to plant growth by the large amounts of organic matter applied in the manure, (2) the fixation of readily soluble nitrogen due to the increased activity of bacteria, and (3) denitrification proper, and it is claimed that many more experiments are needed to determine which of these is the controlling factor.

The use of nitrate of soda as a chemical fertilizer in agriculture and viticulture (*Ann. Sci. Agron., 1899, I, Nos. 1, pp. 38-160; 2, pp. 161-207; 3, pp. 361-458*).—A series of reports of the results of field experiments in the various departments of France.

Is ammoniacal nitrogen of the same value as nitric nitrogen? G. SMETS (*Belg. Hort. et Agr., 11 (1899), No. 19, pp. 293, 294*).

Disposal of sewage and garbage in foreign countries (*U. S. Spec. Consular Rpts., 17 (1899), pp. 13-221*).—This consists of reports on this subject made at the instance of this Department by consular officers at various places in Europe, Asia, Africa, Canada, Australasia, Mexico, Central and South America, and West Indies.

Formulæ for preparing fertilizers for different crops, F. B. GUTHRIE (*Agr. Gaz. New South Wales, 10 (1899), Nos. 7, pp. 605-610; 9, pp. 919, 920; 10, pp. 1061, 1062; 12, pp. 1275-1281*).

Recent progress in the field of fertilizer industry, VON GRUEBER (*Chem. Ztg., 24 (1900), No. 2, pp. 7-10*).—This reviews briefly the general business situation, advances in the manipulation of fertilizing materials, and improvement in scientific and technical processes (especially methods of analysis) relating to fertilizers.

Commercial fertilizers, H. A. HUSTON (*Purdue Univ. Spec. Bul., Aug., 1899, pp. 8*).—This is a second edition of this bulletin containing additional analyses made since the publication of the first edition in May (E. S. R., 11, p. 438).

Fertilizers, F. T. SHUTT (*Canada Expt. Farms Rpts. 1898, pp. 159-161*).—This includes analyses of 6 samples of swamp muck and 2 of Thomas slag, with a brief discussion of the fertilizing value of these materials and of South Carolina phosphate.

Analyses of fertilizing materials, H. SNYDER (*Minnesota Sta. Bul. 63, pp. 508-510*).—Analyses are reported of nitrate of soda, dried blood, tankage, sheep manure, soft-coal soot, peat-bog ashes, sawmill ashes, and hard-wood ashes.

Analyses of commercial fertilizers (*South Carolina Sta. Bul. 45, pp. 23*).—This bulletin completes the report of analyses of fertilizers for the season of 1898-99. It contains analyses and valuations of 149 fertilizers, together with notes on valuation, directions for sampling, and regulations governing the sale of commercial fertilizers in South Carolina.

FIELD CROPS.

Field experiments with farm crops, W. SAUNDERS, R. ROBERTSON, S. A. BEDFORD, A. MACKAY, and T. A. SHARPE (*Canada Expt. Farms Rpts. 1898, pp. 16-69, 111-114, 117-118, 151-153, 242-256, 271-299, 328-351, 377-393*).—These experiments consist as heretofore (E. S. R., 10, pp. 835, 836) of variety, cultural, and fertilizer tests with grain, root, and forage crops. The tests are being carried on at the experimental farms in Ontario, the Maritime Provinces, Manitoba, British Columbia, and the Northwest Territories. The results of the variety tests have been previously recorded (E. S. R., 10, p. 1035). The distribution of seed grain by the Central Station at Ottawa and certain branch farms is noted. The cultural experiments consist of early, medium, and late sowings at different stations of oats, barley, spring wheat, peas, turnips, mangels, and flax; distance experiments with corn; early and late harvesting of root crops; rotation tests, etc. The results of these experiments are tabulated in detail, and in some instances averaged for preceding years.

In Manitoba wheat sown after sweet clover gave better results than when sown on wheat stubble, but not as good as when sown on summer fallow. Rolling the ground before sowing the seed increased the yield of both grain and straw. Seeding with the hoe drill gave better results than seeding with a press drill or sowing broadcast. Five pecks of seed wheat per acre proved better than 4 or 6 pk. per acre. Spring-plowed land proved better for wheat than fall plowed. The earliest seeding of wheat gave the best results. Sprinkling either clean or smutted seed wheat with a dilute solution of copper sulphate decreased the percentage of smutted grain in the harvest. Formalin proved superior to Bordeaux mixture or copper sulphate for controlling the smut in both wheat and oats. Samples of smutted seed steeped in formalin even for 5 minutes gave yields almost free from smut.

The clovers have proven specially valuable as a green manure at the Ontario Station. Data are given as to the fall weights of the leaves and stems and of the roots taken to a depth of 9 in. of mammoth red, common red, and alsike clover, when seeded the preceding spring at different rates per acre. In one instance clover was allowed to grow until the following May before the weighings were made. The weight of the green product was nearly doubled by the additional growth. This fact has an important bearing on the time of plowing under clover for green manuring. In one instance clover seed inoculated with Nitragin gave nearly double the weight of leaves, stems, and roots obtained from seed not inoculated. In other instances it considerably increased the growth of clover. Once the results did not seem to be influenced by its use. Clover seeded with grain did not decrease the yield of grain.

Early sowing and late harvesting gave the best results with turnips, mangels, and carrots. With sugar beets late sowing and late harvesting gave the best yields at Ottawa and the Northwest Territories. In the Maritime Provinces, Manitoba, and British Columbia early sown sugar beets gave the best yields. The sugar content of beets grown in British Columbia varied from 10.4 to 16 per cent. Corn in British Columbia gave the best leaf growth and matured better when the rows were 3½ ft. wide or more. In the Northwest Territories the closer the planting in the case of hill culture the better the result, while in row culture the reverse was true. Early sowings of flax have generally given the best results as regards both seed and straw. Soy beans and horse beans have been successfully grown at all the stations. Planting soy beans in drills from 14 in. to 2 ft. apart has given the best results. When oats and peas were mixed, the seeding containing the largest proportion of oats gave the largest yield of grain.

In the fertilizer experiments at the Central Station, fresh barnyard manure has given the best average results on barley, corn, and carrots of all the different fertilizers and combinations tested during a period of 11 years; and rotted barnyard manure on wheat, mangels, turnips, and potatoes. Mineral phosphate has been discarded as a fertilizer. Ten years' experience with this material has shown it to possess no value as a fertilizer. In rotation tests, wheat alternated with roots or corn has given the largest money returns.

Tabulated data are given as to the date of topping; total weight of first, second, and third grade dried leaves; and estimated total weight per acre of dried leaves of 35 varieties of tobacco. "The Kentucky Burley, White Burley, Yellow Pryor, Yellow Mammoth, Connecticut Seed Leaf, and Pennsylvania Seed Leaf are, taking everything into consideration, probably the most profitable varieties to grow. Some of those which yielded heavier than these were too late in maturing to reach the best condition." Other minor crops grown at the different stations are sunflowers, grasses, Japanese millet, spring rye, buckwheat, rape, and mixed fodder crops.

Report of the agriculturist and horticulturist, A. J. McClatchie (*Arizona Sta. Rpt. 1899, pp. 242-259*).—A report is given of cultural experiments at the station with sugar beets, plants for green manuring, wheat, barley, potatoes, garden vegetables, melons, forage crops, and eucalypti; and of the effect of winter irrigation on orchards. The horticultural work is noted elsewhere in this issue.

Sugar beets.—Seeding at different dates, early irrigation, and planting on adobe soil were problems investigated in the testing of sugar beets. The details are reserved for future publication. The summarized results of the season indicate that beets sown January 18 gave better results than when sown February 13 or 26. Kleinwanzlebener gave better yields than Vilmorin even on heavy clay soils. Winter-sown beets were not benefited by early irrigation. "The best time to apply water is when the beets are between 2 and 3 months old." Fairly good results were obtained at the station when beets were sown in September and harvested the following March.

Green manure plants.—Yellow sweet clover, crimson clover, alfalfa, and different varieties of peas were tested. Dates for seeding and plowing under the different crops and yields of green and dry matter per acre are tabulated. Yellow sweet clover and alfalfa were the only plants which gave satisfactory yields. Crimson clover was not a success and it is thought doubtful whether peas can be profitably sown at the station for green manure. The author states that yellow sweet clover is probably the green manure plant best suited to station conditions.

Wheat.—The object of the experiment with wheat was to find varieties for introduction of better milling qualities than those at present grown. Seventeen varieties were grown, 8 of which were new to the region. The central portion of each plat was dressed with horse manure. Different methods of irrigation were tested. Data for the experiments are tabulated. Sonora, the variety usually grown at the station, proved the earliest of all the varieties tested. It was surpassed in yield, however, by Ruby and Feldspar, varieties from New Mexico. Seven varieties proved superior to Sonora in milling qualities. Of these Rorsa di afulia, Ruby, and Jones Winter Fife are considered the most promising as regards productiveness and earliness. The average increased yield of all varieties due to manuring was 18 per cent. Furrow irrigation gave better results than flooding.

Barley.—Barley was grown for hay and for grain. One bearded, one beardless, and one hulless and beardless variety were tested. The hulless variety lodged the least and gave the largest yield of grain per acre. Both the hulless and the beardless varieties matured earlier than the bearded variety and made hay of excellent quality, though the yield was not quite so heavy as with the bearded variety.

Potatoes.—The period between winter frosts and the intense heat of summer is so short in Arizona that only early varieties of potatoes can be grown. Data for tests of 12 early varieties are tabulated. Early Rose, the variety usually grown at the station, planted February 15, gave the largest total yield. Some of the plats were fertilized with barnyard manure, some with ashes alone, and some with ashes and manure combined. The data are tabulated, but the results are inconclusive.

Mention is made of the forage plants being grown at the station.

Experiments with corn, J. S. NEWMAN (*South Carolina Sta. Bul. 41, pp. 6*).—Tabulated results, with comments, are given on experiments with corn, involving planting, tillage, distance, and fertilizer tests; comparison of kernels from different parts of the ear for seed; and on excessive manuring, tillage, and irrigation.

Corn planted on the level without cultivation, except the cutting out of grass and weeds with the hoe, gave practically as good yields as corn planted in furrows and cultivated shallow the first time, afterwards deep. In general the yield of corn increased with the number of stalks per acre. The largest total yield was obtained when single kernels were planted in rows 4 ft. apart and 1 ft. distant in the row. The alluvial soils on which these experiments were carried out were not benefited by the addition of either commercial fertilizers or compost. Excessive irrigation produced a succulent growth of corn and decreased the total yield.

Cotton, J. S. NEWMAN (*South Carolina Sta. Bul. 46, pp. 4*).—The time of application, kind, quantity, and combination of fertilizers most suited for the production of lint cotton on sandy upland soil with red clay subsoil was investigated. In one group of experiments, fertilizers applied April 30 gave better results than when applied February 17, but on a somewhat lighter soil the early application usually gave better results. The data as to the combinations and amounts of different fertilizers applied and yields obtained are tabulated, but the results are more or less conflicting and no conclusions are drawn.

The effect of nitrogenous fertilizers on the yield and composition of certain grasses, grains, and legumes, W. O. ATWATER and C. S. PHELPS (*Connecticut Storrs Sta. Rpt. 1898, pp. 113-203*).—Experiments along these lines have been in progress at the station since 1888 (E. S. R., 9, p. 746). The object of the investigations has been to determine the effect on the yield and composition of certain farm crops when fertilized with different kinds and quantities of nitrogenous fertilizers used with uniform quantities of potash and phosphoric acid. The relative economy of using the different nitrogenous fertilizers has also been studied.

The plan of the experiment provides for "special nitrogen experiments" in which 320 lbs. of dissolved boneblack containing 53 lbs. of phosphoric acid, 160 lbs. of muriate of potash containing 82 lbs. of potash, and different quantities of either nitrate of soda, sulphate of ammonia, or dried blood, sufficient in each instance to furnish 25, 50, or 75 lbs. of nitrogen per acre, were used; and for "soil test experiments" in which fertilizers containing 53 lbs. of phosphoric acid, 25 lbs. of nitrogen, and 82 lbs. of potash were applied on different test plats, singly and in combinations of two and three. The detailed data for the different experiments since the beginning of the work in 1888 are tabulated and all the results, including those obtained in 1898, are considered together.

The experiments with mixed grasses for hay (E. S. R., 5, p. 578) show a regular increase in yield with each increase in the amount of nitrogen applied in connection with the mineral fertilizers, though the yield when 75 lbs. of nitrogen was applied was but little greater than when only 50 lbs. was used. Mineral fertilizers increased the yield of the mixed grasses but slightly and were used at a financial loss. The net profit resulting from the use of 25 lbs. of nitrate nitrogen in connection with mixed mineral fertilizers was at the rate of $3.05 per acre; when 50 lbs. of nitrate nitrogen was used with mineral fertilizers, the profits averaged $6.61 per acre; and when 75 lbs. of nitrogen was used with the mineral fertilizers, $4.47 per acre. The profits were slightly less when sulphate of ammonia was used as a source of nitrogen, though the proportionate profits with the different amounts applied were about the same.

The protein content of the hay was markedly affected by the nitrogenous fertilizers. It increased quite uniformly with each increase in the quantity of nitrogen applied. On the plats where mineral fertilizers alone were used, the protein content of the crop averaged 7.83 per cent. The protein increased to 7.95 per cent when 25 lbs. of nitrate nitrogen was added to the mineral fertilizers, to 8.46 per cent when 50 lbs. was added, and to 9.42 per cent when 75 lbs. was added; and the effects were practically the same when the source of the nitrogen was sulphate of ammonia.

"The increase in the total yield of protein was relatively much larger than the increase in the total yield of dry matter; for if the yields from the plats upon which the mineral fertilizers only were used be taken as a basis, the relative yields from the plats upon which 25, 50, and 75 lbs. of nitrogen was used in addition to the minerals, were respectively as follows: Of dry matter, 137, 177, and 188 per cent; of protein, 127, 188, and 222 per cent."

With corn, the yield of both grain and stover regularly increased with the amount of nitrogen in the fertilizers applied until the nitrogen in the latter reached 50 lbs. per acre. Increasing the nitrogen content of the fertilizers to 75 lbs. per acre increased the yield but slightly. The protein content of the grain, on the other hand, gradually increased with each increase in the amount of nitrogen applied.

"Thus in the experiments with nitrate of soda as a source of nitrogen, the proportions of protein were as follows: In the corn from the mineral plats, 10.13 per cent; from the plats with 25 lbs. of nitrogen, 10.80 per cent; from the plats with 50 lbs. of nitrogen, 11.50 per cent; from the plats with 75 lbs. of nitrogen, 12.07 per cent."

When sulphate of ammonia was used as a source of nitrogen, the protein increased with each additional amount of nitrogen applied, but the percentages were not so high as when the nitrate of soda was used. An increase in percentage of protein did not follow an increase in the amount of dried blood used, but as only 2 experiments with dried blood were made, the results are not considered conclusive. The most economical results obtained with the different fertilizers on corn were obtained from the plats fertilized with nitrate of soda in connection with the mineral fertilizers at the rate of 160 lbs. (25 lbs. of nitrogen) per acre.

One soil test and 2 special nitrogen experiments were made with oats. The yields and composition of the oats grown on the different plats are tabulated and discussed. Unfavorable seasons and soil conditions make it practicable to draw only general conclusions. "In all the experiments in which nitrogen was used, the yield was markedly increased. In general, the results are similar to those obtained with mixed grasses and corn. The effect of the nitrogen on the composition of the crop, especially of the seed, was quite marked. This was most noticeable on the plats to which nitrate of soda was applied."

Plats of timothy, orchard grass, tall meadow fescue grass, tall red top, tall meadow oat grass, and brome grass were grown. The comparatively small size of the plats made it impracticable to estimate the yield per acre of the different plats, but the composition of each of the different species as influenced by increasing amounts of nitrogen was studied. These data are tabulated. The effect of the nitrogen in increasing the protein of the crop was more noticeable in this instance than with any of the preceding crops mentioned. The average protein content of the grass grown without fertilizers was 7.62 per cent; with mineral fertilizers alone, 7.39 per cent; with mineral fertilizers plus 25 lbs. of nitrogen, 9.72 per cent; and with mineral fertilizers plus 75 lbs. of nitrogen, 12.49 per cent.

The report upon experiments with legumes is confined to cowpeas and soy bean. Mineral manures greatly increased the yields of these crops, but there was no increase whatever in the fodder yield of cowpeas when nitrogen was added to the mineral fertilizers. The yield of soy-bean seed was slightly increased by the addition of nitrogen, but not sufficiently to make its use at all economical. Little relationship seemed to exist between the quantity of nitrogenous fertilizers applied and the dry matter and protein content of the resulting crops of either cowpeas or soy beans, though a slight increase in protein content followed the application of the larger amounts of nitrogen.

The comparative effects of increasing the amounts of nitrogenous fertilizers on the yield of dry matter and protein of grasses and corn as compared with the yields of cowpeas and soy beans by use of similar amounts of the same fertilizers are shown in the following table:

Yields of dry matter and protein in different crops similarly fertilized.

Fertilizers.	Grasses.		Corn, grain.		Cowpeas, green plant.		Soy beans, seeds.	
	Dry matter.	Protein.	Dry matter.	Protein.	Dry matter.	Protein.	Dry matter.	Protein.
	Per ct	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
Minerals only	100	100	100	100	100	100	100	100
Minerals + nitrogen 25 lbs	137	127	135	143	104	100	102	105
Minerals + nitrogen 50 lbs	177	188	165	181	100	101	115	120
Minerals + nitrogen 75 lbs	188	222	168	200	98	100	117	123

The practical results of the work are thought to teach the necessity of adapting the fertilizers to the crops grown. The true grasses, like timothy and redtop, are most benefited as regards yield and composition of crop by the application of immediately available fertilizers like nitrate of soda and sulphate of ammonia during the early stages of growth. Slow-acting nitrogenous fertilizers may be used on corn. The yield of legumes is considerably increased by the application of mineral fertilizers, but is only slightly affected by the use of nitrogenous manures.

Fertilizer experiments with mangel-wurzels, Swedish turnips, and grass (*Rpt. Agr. Expts. Cornwall County Council, 1898, pp. 3–26, 43, 44*).—A large number of field experiments with fertilizers are reported. As a result of 991 experiments, extending over a period of 2 seasons, the following fertilizer formula is recommended for mangel-wurzels: 2 cwt. of sulphate of ammonia, 3 to 6 cwt. of superphosphate, and 2 cwt. of kainit per acre drilled with the seed, and 4 cwt. of nitrate of soda, 4 cwt. of salt, and 2 cwt. of kainit per acre broadcast, the salt and kainit being applied at seed time, 1 cwt. of nitrate of soda per acre just after the roots are hoed, and the remaining 3 cwt. of nitrate of soda in 3 equal quantities at intervals of about 3 weeks.

As a result of 2,047 experiments, extending over a period of 3 seasons, the following fertilizer formula is recommended for Swedish turnips: 6 cwt. of superphosphate, 2 cwt. of kainit, and if there is a probable deficiency of nitrogen in the soil, ½ cwt. of nitrate of soda per acre drilled in with the seed. The results of fertilizer tests on grass are tabulated, but no formula is recommended and no conclusions are drawn.

A preliminary report is made of experiments with fertilizers to determine those best adapted for permanent pasture land. The results of the test are tabulated, but in this case also no conclusions are drawn. An application of 10 cwt. of basic slag and 1 cwt. of muriate of potash per acre gave the best results. giving a yield of 9,333 lbs. of hay as against 4,442 lbs. from a check plat unmanured.

The influence of commercial fertilizers on the quality of the Irish potato, R. J. DAVIDSON (*Virginia Sta. Bul. 92, pp. 97-108*).—A study extending over a period of 3 years was made to determine the effect of different amounts and combinations of commercial fertilizers upon the quality of Irish potatoes, and also to observe in what manner the amount of plant food taken up by potatoes is affected by fertilizers.

Three varieties of potatoes were used: Charles Downing, Early Ohio, and Sunrise, and 23 plats given to the culture of each. The fertilizers used were nitrate of soda, acid phosphate, and muriate and sulphate of potash. Four plats in each series were left unfertilized. The yields and composition of the potatoes grown on each plat are shown in tabular form and the results discussed.

No difference was observable in the effect of the fertilizers on the different varieties of potatoes. The highest percentage of dry matter was found in the potatoes grown on the unfertilized plats, an average for these plats of 22 per cent. The lowest content of dry matter found in any of the samples was 19.91 per cent. These potatoes were grown on plats excessively fertilized with all three essential elements. Between these two extremes considerable irregular variation occurred. The average content of dry matter of potatoes grown on the plats fertilized with muriate of potash was 20.45 per cent and on the plats fertilized with sulphate of potash 21.20 per cent, a slight advantage in favor of potatoes grown with the sulphate. The average starch content of the potatoes grown on the unfertilized plats was 68.37 per cent, and on the fertilized plats 69.54 per cent. On the plats fertilized with the muriate of potash the starch content of the potatoes was 69.99 per cent and on the sulphate plats 69.35 per cent. But little difference was observable in the starch content of potatoes grown on different plats, whether one or more fertilizers were used or whether small or large amounts were applied.

> "It can therefore safely be said, in summing up the evidence as given of these results, that fertilizers have very little effect on the starch content. The starch does not seem to be affected much by either the large or small application, nor does it make very much difference whether we use muriate or sulphate of potash."

The crude ash content of the potatoes seemed to be but little affected by the fertilizers. It was slightly increased when muriate of potash was used, due to an increased absorption of chlorin by the plant. The increase in chlorin was found to vary directly with the amount of muriate of potash used. The conclusions of the author may be summed up as follows:

Commercial fertilizers tend to diminish the content of dry matter in potatoes and to slightly increase the starch and ash content. "Neither the kind nor amount of fertilizers has any appreciable effect on the percentage of nitrogen, phosphoric acid, and potash contained in the potatoes. The percentage of chlorin is considerably increased when muriate of potash is used, and the more muriate used the higher the percentage of chlorin. Potatoes grown with muriate of potash contain less dry matter but slightly more starch than those grown with sulphate of potash."

Experiments on the cultivation of different varieties of tobacco on the Signakski and Sochinski Experimental Tobacco Plantation (*Selsk. Khoz. i. Lyesov., 193 (1899), June, pp. 481–558*).—Variety tests and culture experiments were made to determine the influence on yield and quality of tobacco, of thickness of planting, and of the number of leaves left on the plant when transplanted. The varieties "Platana" and "Samsoon," both of Asia Minor, and "Dubec," of Macedonia, were found best suited to the soils of the region. Results of the culture experiments tend to show that within certain limits the yield of tobacco increases with the thickness of planting and with the larger number of leaves left on the seedlings when transplanted. The thickness of planting has also an important influence on the quality of the tobacco. The greater the distance the plants are set apart, the more inferior the quality; or, stating it in another way, the quality of tobacco improves up to a certain limit with the increased thickness of planting.—P. FIREMAN.

Experiments in the culture of the sugar beet in Nebraska, H. H. NICHOLSON and T. L. LYON (*Nebraska Sta. Bul. 60, pp. 34, figs. 6, dgm. 1*).—This bulletin records the results of cultural and fertilizer experiments and of variety and seed tests with sugar beets during the season of 1898.

The experiments were conducted on a 5-acre plat of typical sugar-beet soil at Ames, in the Platte River Valley. In addition to this experimental plat the station had the privilege of using for purposes of investigation 300 acres of sugar beets, including 30 different varieties, planted by the Standard Cattle Company of the same place. Mechanical and chemical analyses are given of the gumbo and sandy loam soils of this farm. Field notes on the growth of beets on plats differently treated are given, and the results of the different experiments shown in tabular form. The results of the season's work led to the following conclusions:

> "No advantage was derived this year from the use of "large seed" or "heavy seed."
>
> "The most satisfactory method of planting was in rows 18 in. apart, and thinning out the beets to 8 in. in the row, as compared with rows 30 in. apart with beets 4 in. apart, and also as compared with hills 18 by 8 in. apart.
>
> "Shallow cultivation and hoeing are preferable to deep cultivation and hoeing.
>
> "A slightly increased yield of beets was produced by the use of commercial fertilizers, but no improvement in sugar content and purity.
>
> "A comparison of a light soil with a heavy one showed that beets on the former matured more rapidly, but those on the heavy soil attained the higher sugar content and purity."

The labor-saving devices employed in the rapid analysis of between 6,000 and 7,000 specimens of sugar beets, used as mothers for the production of seed, are described in considerable detail, and results given of germination tests of 15 samples of imported sugar-beet seed and of examinations of the same with reference to purity.

Report of the results obtained on the experimental fields at Dodd's Reformatory, 1898, J. P. D'ALBUQUERQUE and J. R. BOVELL (*Rpt. Expt. Fields Dodd's Reform.* [*Barbados*], *1898, pp. 39*).—Part 1 of this report shows the amount and composition of rainfall during the years 1896–1898, and part 2 includes reports of experiments with commercial fertilizers on sugar cane. The size of the plats, nature of the soil, and similar data have been previously noted (E. S. R., 10, p. 40). Results secured in 1898, as shown by tables, are commented upon and summarized. The use of nitrogen, either in the form of sulphate of ammonia, nitrate of soda, or dried blood, with mineral fertilizers resulted in an increase in tonnage of cane, volume of juice, available sugar, and profits. An application of 60 lbs. of nitrogen per acre in the form of sulphate of ammonia led to an increase of sugar and profits, but when the amount was increased to 80 lbs. per acre. a loss followed. Both sulphate of ammonia and nitrate of soda proved superior to dried blood as sources of nitrogen. The use of phosphate fertilizers in addition to nitrogen and potash resulted regularly in a decrease of sugar and profits, except in one instance where superphosphate was used at the rate of 40 lbs. per acre. Increasing the amount of phosphate increased the loss in each instance. The use of potash in connection with nitrogen and phosphoric acid regularly increased the yield of cane, juice, sugar, and profits. The increase of profits was very small, on the average. and was greatest in the case of the plat which received 60 lbs. of potash per acre applied in January.

Applying all the potash in January gave slightly better results than applying part in January and part in June.

A summary of all the experiments shows that applications of 30 tons of barnyard manure were unprofitable. The use of mineral fertilizers alone did not increase the yield of sugar. "Nitrogen was the manurial constituent which chiefly governed the return of sugar and profit. When applied in addition to mineral fertilizers it gave the best return when applied to the amount of 60 lbs. of nitrogen per acre in either of the active forms of sulphate of ammonia or nitrate of soda."

A large number of varieties, mainly seedlings, of sugar cane were tested. Nineteen of the varieties grown yielded over 7,000 lbs. of available sugar per acre, the yields of cane varying from 29 to 48 tons per acre, and the juice containing from 14.45 to 19.27 per cent of sucrose. Some of the best varieties were among the selected seedlings, and of these the best results were given by Burk and Demerara seedlings.

Improvement of cane by selection on the basis of analysis has been undertaken but no results have as yet been reached.

Report on the results obtained on the experimental fields at Dodd's Reformatory, 1899, J. P. D'ALBUQUERQUE and J. R. BOVELL (*Rpt. Expt. Fields Dodd's Reform. [Barbados], 1899, pp. 38*).—This report is similar in character to the report for 1898 (see above). The experiments there reported were continued in 1899 under entirely similar conditions. Hurricanes and drought seriously interfered with the results of the year. "This was especially noticeable with the nitrogenous applications, neither sulphate of ammonia nor nitrate of soda being applied with profit. Dried blood, however, gave an increase in sugar and profit. The addition of superphospate of lime to fertilizers containing nitrogen and potash resulted in every case in loss. In one instance a plat fertilized with 100 lbs. of basic slag gave an increased yield in available sugar and was used at a fair profit." The application of sulphate of potash was in every case followed by favorable results, and these results were most favorable in the case of the plat receiving sulphate of potash at the rate of 40 lbs. of potash per acre, applied in January.

In the variety tests selected seedlings gave better results than older varieties. Among these Demerara seedlings and Barbados seedlings again stand at the head.

Wheat and oats, rye and barley, R. J. REDDING (*Georgia Sta. Bul. 44, pp. 19*).—Popular directions for the culture and manuring of wheat and oats for grain and for the culture of barley and rye for pasture. Part of the data here recorded has been previously noted (E. S. R., 3, p. 387).

Results at the station seem to favor the use of fertilizers for wheat and oats which contain relatively large amounts of nitrogen. Nitrate of soda is especially recommended as a top-dressing for oats. Tests of a number of varieties of oats grown at the station in different years are recorded in tabular form. Texas Rust Proof is considered the most reliable variety to grow in the South. Appler is also a good variety. Winter Turf oats have not proven desirable at the station. Fertilizer formulas are suggested for both oats and wheat.

Memoranda of the origin, plan, and results of the field and other experiments conducted on the farm and in the laboratory of Sir John Bennett Lawes at Rothamsted, England, J. H. GILBERT (*Report to the Lawes Agr. Trust Committee, 1899, pp. 113, figs. 2, dgms. 7*).—This is a report on the work of the Rothamsted Experiment Station containing summarized results of its work from organization to the present time. The year 1899 was the fifty-sixth year of the experiments. The work carried on there has already been fully described in Bulletin 22 of this Office (E. S. R., 7, pp. 372, 380, 385, 387, 390, 398, 415).

Report of the farm overseer, F. GILLANDERS (*New Zealand Dept. Agr. Rpt. 1899, pp. 161-168, 173-197*).—A large number of variety and fertilizer tests with barley, wheat, potatoes, turnips, mangel-wurzels, carrots, sugar beets, kohl-rabi, peas, and cabbage are reported.

Experiments with crops, W. SOMERVILLE (*County Councils Cumberland, Durham, and Northumberland, Tech. Education, Rpt. 6 (1897), pp. 7-116, dgms. 5*).—Results are given of rotation and fertilizer experiments with barley, oats, potatoes, and various root crops grown in the counties of Durham, Cumberland, and Northumberland in England. Fertilizer experiments on pasture and old hay fields are also recorded.

Culture of hardy alfalfa, G. D'UTRA (*Bol. Inst. Agr. São Paulo, 10 (1899), No. 8, pp. 419-463*).—Data on the yield and chemical composition of *Medicago media* and *M. sativa* harvested before, during, and after bloom.

Cotton culture in the German colonies, E. HENRICI (*Tropenpflanzer, 3 (1899), No. 11, pp. 535-548*).

Manuring meadows (*Deut. Landw. Presse, 26 (1899), No. 95, p. 1071*).—Mineral fertilizers were used on low meadows without effect. Nitrogenous fertilizers (nitrate of soda) greatly increased the yields.

Commercial fertilizers for natural and artificial meadows, E. ZACHAREWICZ (*Prog. Agr. et Vit. (Éd. L'Est), 21 (1900), No. 5, pp. 155-160*).—Complete commercial fertilizers were compared with liberal amounts of barnyard and liquid manures for natural and artificial meadows. Both the heaviest yields and the greatest financial profits were obtained on the plats fertilized with commercial fertilizers.

The opuntias, J. W. TOUMEY (*Arizona Sta. Rpt. 1899, pp. 240*).—Mention is made of the work of selection and hybridization of cactus fruits which is now being carried out in the university garden for the purpose of increasing their economic value as food plants.

The ground nut (Arachis hypogæa), C. BENSON (*Dept. Land Records and Agr., Madras, Vol. II, Bul. 37, pp. 136-144*).—Statistics on the decreasing production of peanuts in some of the more important peanut-growing districts of India, with a discussion of the probable cause (soil deterioration) and analyses of 6 peanut soils.

Saltbushes, T. W. KIRK (*New Zealand Dept. Agr. Rpt. 1899, p. 207*).—A brief report is given of experiments with *Atriplex nummularia*, *A. halimoides*, and *A. leptocarpa*. All these plants grew well, were quite resistant to drought, and were freely eaten by stock.

A monograph on the sugar beet, W. HERZOG (*Monographie der Zuckerrübe. Hamburg: Leopold Voss, 1899, pp. VII+170*).

The sugar beet in Italy, C. MANCINI (*La barbabietola da zucchero in Italia. Rome: E. Loescher & Co., 1899, pp. 120*).

Sugar beets, C. D. SMITH and R. C. KEDZIE (*Michigan Sta. Spec. Bul. 10, pp. 4*).—Cultural directions for the use of sugar beet growers.

Manuring sugar beets with potash on heavy soils, C. Fruwirth (*Württemburg. Wchnbl. Landw., 1899, No. 52, pp. 821-823*).

A report of progress in beet and beet seed culture (*Bl. Zuckerrübenbau, 7 (1900), No. 1, pp. 8-12*).—Experiments with manures and fertilizers on sugar beets.

The question of woody beets, A. Krüsemann (*Deut. Landw. Presse, 26 (1899), No. 95, p. 1069*).—To prevent the frequent occurrence of sugar beets going prematurely to seed and thus forming woody roots, the author recommends that spring sowings be delayed, especially when the spring is cold and backward, that the plants be well and frequently fertilized with nitrate of soda during the early stages of growth, and that frequent cultivation be practiced.

The distribution of sugar in beets as related to the paying for beets according to sugar content, A. M. (*Bl. Zuckerrübenbau, 6 (1899), No. 18, pp. 273-283, figs. 11*).

Seedling sugar canes, crop 1899, Carmody (*Bul. Roy. Bot. Gard. Trinidad, 1898, No. 21, pp. 221-223*).—The composition of 39 best canes grown by the botanical department in 1899 is reported. Brief statements are also made concerning the crop.

Improvement of sugar cane by chemical selection (*Sugar, 12 (1900), No. 3, p. 45*).

The cultivation and improvement of tobacco in Spain, J. Rallo y Campuzano (*Tratado del cultivo y beneficio del tabaco en la Peninsula. Madrid: J. de Castro, 1899, pp. 87*).

Culture of tobacco in Mexico (*Tabac, 19 (1899), No. 351, pp. 3, 4; 20 (1900), No. 355, p. 3*).—Brief survey of the possibilities of tobacco culture in Mexico.

Intensive culture of wheat, Herbert (*Culture intensive du blé. Paris: J. B. Baillière & Sons, 1899, pp. 40*).

Studies and investigations on the grain of wheat, E. Frichot (*Études et recherches sur le grain de blé. Paris: J. B. Baillière & Sons, 1899, pp. 237, figs. 25*).

Rust resistant wheats (*Agr. Jour. Cape Good Hope, 15 (1899), No. 13, pp. 837-839*).—Methods of securing rust resistant wheats by selection are noted.

HORTICULTURE.

Tomatoes: Composition and food value; loss of nutrients in canning, H. Snyder (*Minnesota Sta. Bul. 63, pp. 513-517, fig. 1*).—Analyses were made of 3 sorts of tomatoes, with the following results:

Composition of tomatoes.

	Variety.		
	Acme.	Livingston.	Dwarf Aristocrat.
	Per cent.	*Per cent.*	*Per cent.*
Sucrose (cane sugar)	1.60	1.62	1.73
Dextrose (glucose)	1.12	1.12	1.03
Levulose (fruit sugar)	1.13	1.12	1.03
Protein	.50	.50	.44
Amids	.36	.40	.36
Fat	.05		
Malic acid	.37	.47	.41
Ash	.69	.56	.54
Insoluble in acid	.32	.34	.37
Undetermined	.25	.11	.16
Water	93.61	93.76	93.93
Total	100	100	100
Total solids	6.39	6.24	6.07

Some of the constituents were studied in considerable detail. Thus the author found that the same amount of sugar could not be obtained from the dry residue of the tomato as from the fresh material. This change was attributed to the combined action of heat, organic acids, and ferments present.

> "The destruction of the levulose [of the tomato] by the prolonged drying in the presence of the malic acid explains the discrepancy in the sugar percentage of the tomato as obtained by different analysts, because some have obtained their sugar results from the dried residue, while others have used the fresh material. This chemical change is not necessarily confined to the levulose of the fresh sample. When the tomato is dried, the sucrose undergoes inversion, and the levulose thus formed undergoes the same change as the preexisting levulose. That this is true is indicated from the results [obtained] and by direct experiments. . . . This same change was observed when solutions composed of sucrose, levulose, and malic acid were evaporated and heated in a water oven.
>
> "The fact that the mixed sugars of the tomato suffer such a material change in drying indicates that the sugar in the dried residue of fruits and vegetables may not always be taken as representing the sugar content of the fresh substance. Drying in a vacuum would probably be the only way of avoiding these changes. . . .
>
> "The direct extraction of the dry matter of the tomato gives about 0.5 per cent of ether extract, commonly called fat. If the residue is first extracted with alcohol, a much smaller amount of ether extract is obtained, as will be observed from the following results:

	Per cent.
Direct extraction of residue	0.49
After extraction with alcohol	.05
Ether extract 1, soluble in alcohol	.41

> "From these results it is evident that about 90 per cent of the ether extract of the tomato consists of non-fatty material."

The loss of nutrients by rejecting the juice in canning tomatoes was investigated, a comparative test being made in which cans were prepared with and without juice. As shown by analysis there was a loss of 22 per cent of the total sugar when 3 lbs. of tomatoes was canned without juice.

Report of the horticulturist, W. T. MACOUN (*Canada Expt. Farms Rpts. 1898, pp. 93–110, 111–117, 119–121, pls. 3*).—Historical notes are given on Russian fruits grown at the Central Experimental Farm since 1888, with descriptive notes on a number of varieties of apples, pears, plums, and cherries. Tests are reported of 25 varieties of grapes, 50 of currants, and 25 of strawberries. Descriptions are given of 4 new varieties of gooseberries originated by W. Saunders.

The cover crops sown August 1, 1897 (E. S. R., 10, p. 849), "came through the winter in splendid condition." Contrary to the usual practice, clover sown as cover crop in the orchards was not plowed under, partly because the soil in the orchard is a sandy loam which is easily moved by the wind, and partly to determine whether the trees would suffer in time of drought. Notwithstanding an exceptionally dry summer, neither clover nor orchard seemed affected by drought except in a small part of the Russian orchard.

Descriptive notes are given on a number of seedling apples, pears, and plums. A list is given of those vegetables which have proved best and most satisfactory at the Central Experimental Farm. Tests are reported of 25 varieties of peas and 103 of tomatoes. The 6 wrinkled varieties of tomatoes which gave the best average yields in 3 years are Early Bermuda, Extra Early Jersey, Early Richmond, Money Maker, Democrat, and Conqueror. The 12 smooth varieties which have given the best results in the same time are Brinton Best, Baltimore Prize Taker, Extra Early Advance, Canada Victor, Comrade, Mayflower, Livingston Favorite, Early Ruby, Cardinal, Atlantic Prize, Thorburn Longkeeper, and Matchless.

Brief mention is made of the progress of the work in forestry. The arboretum has been much augmented during the year.

The pruning of young fruit trees, G. H. POWELL (*Delaware Sta. Bul. 45, pp. 16, figs. 7*).—The author discusses the stub or Stringfellow method of root pruning, presents the results of root pruning experiments carried out on heavy clay land and light sandy loam with different sorts of fruits, and gives some general considerations based on the experiments relative to the formation of root systems of newly planted trees.

In 1896, 54 trees each of two-year old Astrachan apple, two-year old Bartlett pear, one-year old Crawford Early peach, and one-year old Abundance plum on Marianna roots, were planted at the experiment station and in duplicate at Seaford.

> "The land at the experiment station is a heavy, well-drained, clay loam, with a stiff subsoil 8 or 10 in. beneath the surface. The land at Seaford is a warm, well-drained sandy loam, with a stiff subsoil 2 ft. below the surface. The Newark soil is frequently frozen from December to March, while at Seaford it is not unusual for it to remain open the entire winter. . . . The roots of one-third of the trees were pruned to a length of 8 to 10 in., another third to a length of 3 in., and on the remaining third the roots were 'cut back just below the collar and just under the first good side roots,' where the root formation allowed of the Stringfellow cut."

Another lot, consisting of 22 trees each of apples, pears, plums, and peaches of the same age and variety as those noted above, were planted on the station ground in the spring of 1898. One-half of the trees of each variety were root pruned within 3 in. of the stem and the other half were pruned to stubs.

The trees in these experiments were photographed before planting, and were "taken up at various times to study their root formation, the last trees being removed in May, 1899." The results, given in condensed notes and tables, are summarized in the following table:

Growth of fruit trees root pruned to different lengths.

Locality.	Total number of trees pruned.	Number of trees lived out of 72 pruned to—			Number of first-class trees out of 72 pruned to—		
		6 to 8 inches.	3 inches.	Stubs.	6 to 8 inches.	3 inches.	Stubs.
1896.							
Station grounds, heavy clay loam	216	63	70	45	59	66	16
Seaford, sandy loam	216	68	72	62	62	69	37
1898.							
Station grounds, heavy clay loam	88	....	37	30	....	16	3

In order to observe the behavior of stub-pruned peach trees under orchard conditions, 20 trees of the Emma variety were planted in the fall of 1896 across a new peach orchard. The land was warm, well-drained, sandy loam. "Sixteen of the trees lived and in the summer of 1899 could not be distinguished from those in the adjoining rows."

The general results of the experiment lead the author to conclude that the "stub-pruning system is not one of universal application. The method is a practice with local merit rather than a system that is founded on sound principles of plant growth." It is "meritorious chiefly from the economic advantage of handling and planting the trees and wherever its value in a given locality is determined by experimental effort, it would seem a wise policy to adopt it." Long-rooted trees have not behaved as well as those with roots of medium length and it is advised that "Delaware orchardists should prune the roots of fruit trees to a length of 3 to 5 in. at transplanting. Shorter roots present no emphatic advantages, the longer roots are useless and expensive to set in the ground. The ends of broken roots should be removed and the fibrous roots protected from unnecessary exposure."

The author found a wide variation in the development of root systems on different sorts of fruit trees, which suggested the "impracticability of formulating a method of root treatment applicable to all fruit trees." Stub-pruned trees either on light sand or heavy clay failed to develop roots which took a more downward course than the roots of trees otherwise pruned.

"New roots arise from the ends of pruned roots, from fibrous roots, from adventitious buds at the base of the tree, and sometimes from the sides of the larger roots. They arise most easily from the smallest roots. Shortening the roots induces a development of adventitious roots which may compensate the tree for the loss of its smaller feeders. A long root is useful to a transplanted tree mainly to anchor it in the soil while the new roots are forming. Fibrous roots may be of importance to a transplanted tree in that the earliest feeders are developed from them. The vitality of the fibrous roots is not destroyed where trees are carefully handled.

"The direction which the new root system assumes is governed by the character of the soil, by the distribution of plant food and moisture in it, and by the natural habit of the tree. The roots seek the strata of most congenial moisture and accessible plant food.

"Stub-pruned trees are at a disadvantage on heavy soils, on soils that freeze deeply throughout the winter, in a dry fall or spring, or in soils that are slow in warming.

"Stub-pruned trees, with branches shortened to correspond, frequently develop a one-sided root system and an ill-formed top."

Lelong's nurse root process (*Pacific Rural Press; abs. in Montana Fruit Grower, 9 (1899), No. 22, p. 2*).—Lelong's method of growing trees from branches, as given by himself, is as follows: Remove the dirt from the sides of the mother tree until a root the size of a pencil or larger is found. Taper the root to a wedge-shape and graft it obliquely on the branch about 3 in. from the base end. The branch should be of the same species as the standing mother tree. Cover both root and limb with sand and bank the sand around the grafted branch a foot above the ground. The sand should be kept moist by watering 3 times daily. Three or four branches can be nursed by the same mother tree. Under this treatment the base end of the branch calluses and throws out roots while being nourished by the root of the foster mother tree. The following season the branch may be transplanted "a healthy and vigorous tree" and another branch propagated on the same root. This process can be repeated several times. Limbs of a Washington navel orange tree 2 ft. long have been thus grown on roots and have produced "within a few months growth equal to 3 or 4 years with the ordinary method." The process has been applied to 4,000 trees now in Mr. Lelong's nursery and 200,000 specimens of navel orange nursery stock will be treated in the same manner the coming season.

Effect of winter irrigation of orchards, A. J. McClatchie (*Arizona Sta. Rpt. 1899, pp. 257–259*).—Arizona orchardists consider it advisable to irrigate at least once each month from March to September. In order to ascertain how much of this summer irrigation might be rendered unnecessary by the application of an abundance of water during the winter when water for irrigation is most plentiful, an isolated peach and apricot orchard was irrigated 8 times from December to the last of March, after which water was withheld until the end of June. The orchard was cultivated 3 times during the following 3 months. The water content and degree of saturation of the soil were determined in April, May, and June for each foot of soil from the surface down to ground water, a depth of 34 ft. The data obtained, together with notes on the character of each foot of soil, are given in tabular form. The results show that the irrigation water had penetrated to a depth of at least 24 ft.

> "At the time of taking the second set of samples, excepting in the surface mulch, the percentage of water had not decreased much in the upper 4 ft. The amount that had passed through the surface of the soil and through the trees having been about replaced by capillary attraction upward. As a whole, however, the water in the soil had settled. At the time of taking the third set, though the surface soil had become quite dry, there was still an abundance of water within reach of the roots, the amount still available being equivalent to a rainfall of about 25 in."

Trees cultivated under these conditions produced a healthy growth and were well laden with fruit. The apricots made an average growth of 4 ft. per tree and the peaches and apricots that had ripened were considerably larger than usual.

An examination was made of soil in an orchard which had not been irrigated during the winter, but which had received 3 irrigations in April. Below the fourth foot the soil was practically air dry. "In a field which had not been irrigated for 3 years the average water content in the upper 21 ft. of solid clay was but 9.8 per cent during the same month."

Examination of the soil showed an abundance of orchard-tree roots to a depth of 14 to 16 ft., and one peach root was followed into the twentieth foot.

The results of the season's experiments are considered as emphasizing the importance of winter irrigation. "This applies not only to orchard trees but to alfalfa or any other deep-rooted crop."

Root killing of apple trees, N. E. HANSEN (*South Dakota Sta. Bul. 65, pp. 32, pls. 5*).—At the South Dakota Station "apple root-grafts root kill every winter unless deeply covered." During the winter of 1898–99, practically all nursery stock at the station root killed, notwithstanding much of it was heavily banked. The stock included Russian and native seedlings of *Pyrus malus*, Siberian and French crabs, and wild crab from Iowa. The scion roots of all the cultivated apples, including Hibernal, Anisim, Repka Malenka, and Recumbent, also winterkilled. A study of the wood of all cultivated varieties showed that the Hibernal type, as represented by Hibernal and Recumbent, was the hardiest of the whole list of native cultivated apple trees. Tables show the number and variety of apples root killed during the 2 winters, 1896–97 and 1898–99.

There was one exception to the general destruction of seedling roots during the winter of 1898–99. Russian seedlings of *Pyrus baccata* came through the winter in perfect condition. The habitat of this apple is discussed and botanical descriptions, taken from Regel's "Russian Dendrology," given of 12 varieties of *Pyrus baccata* and of 10 varieties of large fruited Siberian crab, *P. prunifolia*. In the author's opinion, the dwarfing tendency of *P. baccata* will probably make its use as a stock of little value in commercial orchards, except in sections where root killing is a source of constant trouble. This dwarfing tendency may, however, prove advantageous on some of the rich soils of the Northwest where apple trees are "prone to form wood instead of bearing fruit." In the neighborhood of the stations and for similar climates the author believes *P. baccata* will prove especially valuable as a hardy stock in test winters.

The early experiments of orchardists in Wisconsin, Iowa, and Minnesota are reviewed. The data show that in the Northwest "the cultivated apple makes a poor union, as a rule, in top grafting upon Siberian crab. In most cases the top outgrows the stock." Top grafting of many varieties on Siberian crabs tends to earlier bearing and shorter life. "Piece-root grafting of Siberian crab seedling roots has been tried quite extensively and the general experience is unfavorable."

The station tested in a limited way the value of growing stocks from hardy varieties of cultivated apples. Seed was selected from Iowa, Minnesota, and South Dakota and planted in the spring of 1897. None of the stock lived through the winter of 1898–99.

The relative merits of bud and piece-root grafting are considered. Piece-root grafts have given the better results in the Northwest because of the opportunity of the deeply placed scion to form its own roots, but even these roots are not hardy against test winters.

"From the evidence at hand it appears that no piece-root grafting will avail. No roots from the scions should be permitted. Stocks for a fair test should be handled much like the Mahaleb or Mazzard stocks for the cherry in Eastern nurseries, setting stocks in nursery first and afterwards when established budding the cultivated apples upon them."

As an aid to the protection of nursery stock the author strongly advises watering trees in the fall before the ground freezes and then applying a heavy mulch.

The keeping qualities of winter apples, P. YOUNGERS, JR. (*Colorado State Bd. Hort. Rpt. 1898, pp. 39, 40*).—Thirty-four varieties of winter apples were gathered in the fall of 1897, mostly in October, and placed in cold storage at a uniform temperature of 36° F. Previous to barreling, each apple was wrapped first in a sheet of waxed paper, using 9 by 12 in. sheets for small apples and 12 by 12 in. sheets for large ones, then in common newspaper. The apples were examined once each month from June to November of the following season. The keeping qualities of the different varieties were marked on a scale of 10 at each examination. The data are tabulated. When the apples were first examined, June 15, the varieties Ben Davis, Winesap, Genet, White Winter Pearmain, Limbertwig, Allen Choice, Willow Twig, Sweet Russet, Little Red Romanite, and Lansingburg were in perfect condition. Four and one half months later, or November 1, when all the apples were removed from cold storage, all these varieties were still in perfect condition, excepting White Winter Pearmain, Sweet Russet, and Allen Choice.

"At the time of the second and third markings, the Jonathan and Grimes Golden Pippin had gained in the comparative scale, coming out of storage in very good condition with flavor fully retained; while the Minkler had lost flavor and begun to decay. The English Golden Russet shriveled and lost on scale. The Roman Stem became mealy and lost flavor. The Sheriff and Walbridge discolored so badly as to render them unfit for show or market and declined very rapidly in the scale of points. The Fulton shriveled. The Milan, though a good keeper, lost color. The Snow retained color but many burst and after a few days became mealy. The Yellow Bell-Flower had decayed so badly at the time of the second marking that we were unable to get a specimen for exhibition. The Missouri Pippin, while remaining sound, lost color, thus reducing the scale. Salome remained firm upon the table. Fruit taken from storage and put upon the tables June 1 retained color and firmness for nearly 5 weeks."

A test was made of the comparative value of wrapping apples and storing them without wrapping. A few varieties each of Ben Davis and Winesap were placed in the cold-storage room in the fall with the other apples without being wrapped. The following June fully 70 per cent of the unwrapped apples were decayed and those remaining in a firm condition were so badly discolored and had lost flavor to such an extent as to render them wholly unfit for either show or market. "A few of the same varieties were wrapped simply in newspaper, not using waxed sheets. Of these about 30 per cent were in very poor condition June 1, while the same varieties picked and stored at the same time, using the double wrapping of waxed sheets and common paper, remained in almost perfect condition as late as November 1."

The date palm, J. W. TOUMEY (*Arizona Sta. Rpt. 1899, pp. 239, 240, figs. 2*).—Work on the date palm supplementary to that previously noted (E. S. R., 10, p. 851) is given. Samples of all the dates ripening in Arizona and specimens from California and Mexico were collected and weighed and analyzed with regard to the relative proportion of flesh to pit; and these data were compared with similar data obtained in the analyses of 6 samples of commercial dates collected in the open market. In a study of seedling dates grown in Arizona in the fall of 1898, less than 40 per cent were found edible and only about 10 per cent could be considered acceptable. Bartlett and Bennett seedlings compared favorably with fair grades of imported dates. They were of "excellent quality and flavor and of fair size . . . Of the 2 imported dates on the station farm that fruited the past season the variety 'Amreeyeh,' a dark date, was of fair flavor and quality. The pit, however, was exceptionally large. The fruit borne by the variety 'Seewah,' a light date, was of fair size and the pit medium, but the flesh was dry and stringy. Lack of sufficient irrigation probably accounts for the unsatisfactory condition of the fruit."

Work in cooperation with this Department is in progress toward the establishment of a 15-acre date orchard in the Salt River Valley.

Report of the horticulturist of the Nova Scotia Experimental Farm, W. S. BLAIR (*Canada Expt. Farms Rpts. 1898, pp. 263–270, pls. 2*).—Notes on ornamental plants, vegetables, and small fruits.

Report of the superintendent of the experimental farm for Manitoba, S. A. BEDFORD (*Canada Expt. Farms Rpts. 1898, pp. 303–308, 313–325, pl. 1*).—Notes on the fruits, vegetables, and flowers at the station. A large number of crossbred apples have been planted for the purpose of selecting more hardy varieties.

Report of the superintendent of the experimental farm for Northwest Territories, A. MACKAY (*Canada Expt. Farms Rpts. 1898, pp. 352–358, 361–368, pls. 2*).—Notes on vegetables, ornamental plants, and fruits. Tests have been made of grafting new crossbred varieties of apples on *Pyrus baccata* and *P. prunifolia* roots. Many of the grafts did not grow. No general statement of the results is made.

Report of the superintendent of the experimental farm for British Columbia, T. A. SHARPE (*Canada Expt. Farms Rpts. 1898, pp. 393–412, pl. 1*).—Notes on a large number of varieties of apples, pears, plums, cherries, currants, raspberries, blackberries, and strawberries.

Effect and limitations of grafting, D. B. MILLER (*Trans. Indiana Hort. Soc. 1898, pp. 182–186*).—The interrelation of stock and scion is discussed. The report is based on experiments made at Purdue University in grafting tomatoes on potatoes, gooseberries on currants, box elder on honey locust, apples on peaches, peaches on currants, grapes on peaches, apples on honey locust, and box elder on peaches and walnuts.

Garden vegetables and melons, A. J. MCCLATCHIE (*Arizona Sta. Rpt. 1899, pp. 252–255*).—Brief notes are given on the growth of string beans, cabbage, sweet corn, lettuce, peas, squashes, tomatoes, spinach, turnips, beets, radishes, carrots, eggplants, and onions, with tabulated data for tests as to the yields of 43 varieties of melons which had ripened fruit up to July 4. Some of the Russian varieties of melons under cultivation at the station for the first time are proving superior, as regards earliness and yield, to older station sorts.

Water-culture experiments with kohl-rabi to determine the plant foods necessary in the head formation of this plant, R. OTTO (*Ber. Deut. Bot. Gesell., 17 (1899), No. 4, pp. 139-144*).

Self-sterility—an orchard problem, S. W. FLETCHER (*Proc. New Jersey State Hort. Soc. 1899, pp. 130-158*).

Nomenclature, S. A. BEACH (*Proc. Western New York Hort. Soc. 1899, pp. 88-96*).—A list is given of the synonyms of a large number of orchard and small fruits, with remarks on horticultural nomenclature.

The development of the buds in some of our common orchard fruits, W. R. LAZENBY (*Jour. Columbus Hort. Soc., 14 (1899), No. 3, pp. 138-142*).—The characteristics of the fruit and leaf buds of peaches, apricots, apples, plums, pears, cherries, grapes, blackberries, raspberries, and quinces are discussed.

Oregon fruits, wild and cultivated, J. R. CALDWELL (*Oregon Bd. Hort. Rpt. 1898, pp. 336-348*).

Some principles bearing on the amelioration of fruits, J. CRAIG (*Trans. Indiana Hort. Soc. 1898, pp. 202-207*).

Fruit trees along highways, E. RATOIN (*Rev. Sci. [Paris], 4. ser., 12 (1899), No. 15, pp. 467-470*).—The relative profitableness of growing fruit and forest trees along public highways is considered. The discussion is based on the cost of planting, care and management, and returns of several highways in different European states. On the whole the greatest profits have resulted from planting fruit trees.

Pruning and cultivating the peach, R. MORRILL (*Proc. Western New York Hort. Soc. 1899, pp. 52-57*).—The author gives his method of cultivating, pruning, and managing a 100-acre peach orchard in Michigan.

A comparison of some varieties of plums, W. J. GREEN (*Jour. Columbus Hort. Soc., 14 (1899), No. 3, pp. 144-148*).—Varieties of plums in the different groups of European, Japanese, and American plums, are discussed with regard to period of ripening, size, beauty, and quality of fruit, prolificness and precocity of trees, susceptibility to attacks of diseases and insects, and hardiness. Lists of suitable varieties for market and home use are given.

Notes on the edible berries of Alaska (*Plant World, 3 (1900), No. 2, pp. 17-19*).—The author describes a number of wild and cultivated berries found in Alaska and notes their use as food by the natives and other residents.

Variety tests of strawberries, W. B. ALWOOD and H. L. PRICE (*Virginia Sta. Bul. 91, pp. 81-94*).—Tabulated data for tests of 91 varieties with descriptive notes on each variety. The following were found to be the most promising varieties: "*Early*—Early Sunrise, Great Pacific, Darling. *Medium early*—Bismark, Clyde, Cobden Queen, Drouth King, Greenville, Maytrot, Mele, Mexican, Noland, and Tennessee. *Late*—Bethel, Enormous, Gandy, Jerry Rusk, Lady Franklin, Marguerite (home use), Marietta, Orewiler, and Splendid."

Fruit evaporation, H. E. DOSCH (*Oregon Bd. Hort. Rpt. 1898, pp. 440-446*).—Directions based on experience are given for evaporating prunes, pears, and apples.

Coffee, culture and preparation for market, H. LECOMTE (*Le café, culture, manipulation et production. Paris: Carré & Naud, 1899, pp. VI+344*).

The principles of pruning the coffee tree, A. CHATIN (*Rev. Agr. Réunion, 5 (1899), No. 10, pp. 441-446*).—This article outlines a rational method of coffee pruning, as suggested by a study of the life history of the plant. In order to overcome the habit which the tree has of fruiting principally on alternate years, especially in the earlier stages of its life history, the author recommends the removal of a part of one of the two primary branches of each cluster at the end of its first year of growth and before the appearance of the flower buds.

Viticulture as an agricultural industry, C. MAYER (*Agr. Jour. Cape Good Hope, 15 (1899), No. 10, pp. 645-651*).—The extent and profits of this industry in Cape Colony are considered.

Viticulture in the United States (*Bol. Not. Agr., 27 (1899) No. 27-28, pp. 951-1027, figs. 47*).—A comprehensive review of the grape and wine industry in the United States.

The Baltet pruning tables—the proper pruning of flowering shrubs, C. W. SEELYE (*Proc. Western New York Hort. Soc. 1899, pp. 47-52*).—Alphabetical arrangement of small trees and flowering shrubs into groups, according to the season when they are best pruned.

Cannas—the varieties to select and how to grow them, H. BALLOU (*Jour. Columbus Hort. Soc., 14 (1899), No. 3, pp. 133-135*).—The characteristics of a number of varieties of cannas are noted and suggestions given regarding canna culture.

Helleborus, or Christmas rose, K. C. DAVIS (*Amer. Gard., 21 (1900), No. 265, pp. 40, 41, fig. 1*).—Key to garden species and varieties of Helleborus.

Commercial violet culture, a treatise on the growing and marketing of violets for profit, B. T. GALLOWAY (*New York: A. T. de La Mare Printing and Publishing Co., 1899, pp. 224, figs. 61*).—The author has endeavored to give every necessary detail of handling the soil, erection of houses and frames, management of the plants as regards propagating, selecting, cleaning, watering, etc.; the temperature conditions and ventilation, and directions for handling and marketing the crop. The diseases and insect enemies of violets and methods of combating them are considered at some length, and estimates made of the cost of production of violets and the profits in the business.

Ornamental trees and shrubs, C. C. LANEY (*Proc. Western New York Hort Soc. 1899, pp. 97-102*).—Descriptions and recommendations of a large number of desirable ornamental trees and shrubs for planting.

Tree life in cities (*Gardening, 8 (1899), No. 175, pp. 98, 99*).—Observations on different species of shade trees growing in the streets of Philadelphia.

Trees for avenue planting, S. A. BEDFORD (*Canada Expt. Farms Rpts. 1898, p. 310*).—Three kinds of trees have been used for this purpose and at the present time 3 miles of roads have been improved by planting double rows of the trees, the kinds used being the native ash-leaved maple, native spruce, and Russian poplar (*Populus bercolensis*).

Landscape gardening as applied to home decoration, S. T. MAYNARD (*New York: John Wiley & Sons, 1899, pp. 338, figs. 168*).—This book treats of all the usual problems involved in the art of landscape gardening, and is accompanied with numerous illustrations and designs. Considerable space is given to the culture, care and management, and description of a large number of the more desirable ornamental trees, shrubs, hardy herbaceous plants, bedding plants, climbers, hardy ferns, ornamental grasses, and aquatic plants. Country roads, walks, drives, parks, school yards, improvement of old homes, and the like are considered; and chapters given on the insects and diseases injurious to ornamentals, and on the home fruit garden.

How to plan the home grounds, S. PARSONS, JR. (*New York: Doubleday & McClure Co., 1899, pp. 249, figs. 56*).—"The purpose of this book is to set forth briefly some simple basic principles concerning the processes whereby home grounds can be made beautiful." In Part I of the work, suggestions are given regarding the selection of the home grounds and the location of the site for the home, the roads, paths, lawns, flower gardens, and terraces; the selection of deciduous and evergreen trees, hardy herbaceous plants, vines and climbers, bedding plants, and aquatic plants for pools and streams; and the ornamental use of rocks, fences, bridges, summerhouses, etc. Plantations and residential parks are also considered, and sample forms of contracts and specifications for laying out parks, etc., given, together with a list of plants for general use on home grounds. The list of best trees and shrubs given is considered by the author as being one of the most important features of the work.

Part II is occupied chiefly with brief considerations of parks, cemeteries, and railroad stations, as typical examples of the more extended development of basic principles involved in landscape gardening of home grounds.

Landscape gardening, F. A. WAUGH (*New York: Orange Judd Co., 1899, pp. 152, figs. 35*).—A "treatise on the general principles governing outdoor art; with sundry suggestions for their application in the commoner problems of gardening." Part 1 of this work considers briefly the art and the artist; part 2 discusses rather comprehensively the artistic qualities of landscape composition; part 3 takes up the general problems involved and the application of the art in entrances, drives, walks, streets, avenues, suburban lots, farm yards, school yards, public parks, and in the use of water; and part 4 considers the gardener's materials; select trees, shrubs, hardy perennials, desirable annuals, bulbous plants, and climbers are briefly described and their use pointed out. The work concludes with a bibliography of 11 European and 11 American books on the subject.

FORESTRY.

Notes on the forest conditions of Porto Rico, R. T. HILL (*U. S. Dept. Agr., Division of Forestry Bul. 25, pp. 48, pls. 8, figs. 9*).—This report is a preliminary statement concerning the forests and forest conditions as observed by the author in a rapid reconnoissance of the island. The natural conditions affecting forest growth, such as configuration, geological formation, and climate, are discussed at some length.

The forest aspects of the island and the floras of the different regions are described. The characteristics of 15 of the principal woods are given at some length and the other forest-tree products are commented upon. Notes are given in which methods of lumbering are described, and some of the problems of reforestation are set forth. The island is said to be almost wholly without virgin forest, but the author thinks by proper management the present condition of barren mountain sides could be speedily covered with productive trees.

Forest trees, A. MACKAY (*Canada Expt. Farm Rpts. 1898, pp. 358–361, pl. 1*).—Notes are given on the present condition of a number of the forest tree and experimental plats at the Northwest Territories Experimental Farm. Among those most promising are the American cottonwood (*Populus deltoides*), the Russian poplar (*P. bereolensis*), and the ash-leaved maple.

A report is also given of the cost of planting and maintaining half-acre plats of box elder and green ash for 4 years. The trees were set out at distances of 2½, 3, 3½, and 4 ft., in each direction. The cost of planting and maintaining for 4 years ranged from $6.55 to $7.60 per half acre.

Two additional half-acre plats were seeded in rows 2½ ft. apart with box-elder and green-ash seed, the cost of sowing and maintaining for 4 years for the 2 lots being $5.92 and $9.06, respectively.

Notes are given on the number of species of trees and shrubs which have been planted in the arboretum, and the varieties and species added in 1898 are mentioned in detail. The total number of species and varieties is now 230.

Cost of planting and maintaining forest trees, S. A. Bedford (*Canada Expt. Farms Rpts. 1898, pp. 309, 310*).—In the spring of 1895 a plantation of 1 acre was planted with two-year-old seedlings of the native ash-leaved maple and white elm, the object being to ascertain the cost of planting and maintaining an acre of trees until they are large enough to shade the ground.

The cost of planting and maintaining the plantation for 4 years is given in detail, from which it appears that it had been maintained at a total cost of $16.25 per acre.

Another experiment of this sort has been begun with elm, maple, and ash, with alternate rows of sand cherry, the object being to ascertain how quickly the sand cherry will shade the ground and save the labor of further cultivation.

The heating capacity of wood (*Queensland Agr. Jour., 4 (1899), No. 7, pp. 105*).—In a brief quotation, the common supposition that the heating capacity of hard wood is greater than that of soft wood is corrected. It is claimed that repeated investigations have shown that the greatest heating power for a given quantity is possessed by one of the softest varieties of wood, namely the linden. Representing the heating capacity of this wood by 1, others reported upon would rank as follows: Fir 0.99, elm and pine 0.98, willow, chestnut, and larch 0.97, maple and spruce fir 0.96, black poplar 0.95, alder and white birch 0.94, oak 0.92, locust and white beech 0.91, and red beech 0.90.

The United States forest ranger system, B. Hermann (*Forester, 5 (1899), No. 9, pp. 195–199*).—An account is given of the management of the national forest reserves which are located in 11 States and Territories and contain an aggregate of about 46 million acres. The general plan shows that they are under the control of a superintendent and supervisor and a number of rangers. The latter patrol the district to extinguish fires and report on various infractions of the law.

The reserves are distributed as follows: Arizona—Grand Canyon, San Francisco Mountain, Black Mesa, and Prescott reserves; New Mexico—Pecos River and Bitter River reserves; Northern California—Stanislaus, Sierra, and Lake Tahoe forest reserves; Southern California—Pine Mountain, Zaca Lake, San Bernardino, San Gabriel, San Jacinto, and Trabuco Canyon reserves; Colorado—Battlement Mesa, Pikes Peak, Plum Creek, South Platte, and White River Plateau reserves; Utah—Fish Lake and Uintah reserves; Idaho—Bitter Root and Priest River reserves; Montana—Bitter Root, Flathead, Lewis and Clarke, and Gallatin reserves; Oregon—Cascade Range, Bull Run, and Ashland reserves; Dakota and Wyoming—Black Hills, Teton, Yellowstone National Park, and Big Horn reserves; and Washington—Priest River, Olympic, and Mount Rainier reserves.

Wood seasoning by electricity, E. T. Liefeld (*U. S. Consular Rpts. 1899, No. 226, pp. 499, 500*).—A description is given of a new process of seasoning wood and timber by electricity. The effect of the electric treatment seems to be to expel the sap and replace it by insoluble matter, by which the resistance and tenacity of the wood is increased and the liability to decay diminished. A solution consisting of 10 per cent of borax, 5 per cent of resin, and 0.75 per cent of carbonate of soda is used, and when the current is turned on the solution is said to replace the sap of the log.

A primer of forestry, G. Pinchot (*U. S. Dept. Agr., Division of Forestry Bul. 24, pp. 88, pls. 47, figs. 83*).—This is the first of a series of primers relating to forestry and trees of the forest, and deals with the units which compose the forest and its character as an organic whole. The enemies of forests are described at considerable length. The tree as an individual and as a community is described, and the various enemies before us are described.

Forest trees, S. A. Bedford (*Canada Expt. Farms Rpts. 1898, p. 309*).—A report is given of the condition of trees on the shelter belts and plantations conducted at the experimental farm at Manitoba. A list of trees is given which are believed to be most suitable for general planting in that region, as follows: Russian poplar (*Populus petrowskiana*), cut-leaved birch (*Betula alba laciniata*), dwarf birch (*B. pumila*), American alder (*Alnus viridis*), Rocky Mountain spruce (*Picea pungens*), European larch (*Larix europaea*), and *Thuya occidentalis elwangeriana.* All of these trees are reported as growing with great rapidity and withstanding the winters of that region.

Notes on a late oak, A. Jolyet (*Bul. Soc. Sci. Nancy, 2. ser., 14 (1898), No. 33, pp. 127–132, pls. 4*).—An account is given of a cultural variety of *Quercus pedunculata.* This variety, by leafing and flowering later than the species, is less liable to injury from late frosts. It is said to be less attacked by insects than other oaks.

Eucalypti, A. J. McClatchie (*Arizona Sta. Rpt. 1899, pp. 255–257*).—Work with these trees has been conducted along lines of "(1) Identification of trees of the various species now growing in the region; (2) propagation of young seedlings for planting, and (3) testing of a large number of species secured from California." All the results thus far secured point to *Eucalyptus rostrata* as the species best adapted to the climate of Arizona.

Miscellaneous notes, S. A. Bedford (*Canada Expt. Farms Rpts. 1898, pp. 310–313*).—Notes are given on the arboretum, condition of the trees, additions during the year covered by the report, descriptions of a number of hardy ornamental shrubs and hedge plants, and a report on the distribution of tree cuttings, 25,000 of which were prepared and sent out.

SEEDS—WEEDS.

The resistance of seed to high temperatures, V. Jodin (*Compt. Rend. Acad. Sci. Paris, 129 (1899), No. 22, pp. 898, 899*).—It is stated that seed of wheat in vacuum may be heated to 100° C. without destroying its germinative power. Similar results may be obtained without the use of a vacuum if the temperature be gradually raised and the hygrometric relation between the seed and the air properly controlled. Pea and cress seeds heated directly for 6 hours at 98° C. were killed, but heated for 24 hours at 60° and afterwards to 98° they retained their germination to a considerable extent, 30 per cent of the peas and 60 per cent of the cress seeds germinating.

It is further shown that pea and cress seeds heated in sealed tubes to 40° C. lost their germinative power after about 20 days, but when quicklime or some other drying agent was introduced with the seed they were kept at 40° for 206 days without in any way diminishing their germinative ability. The author states that it is a practice in the museum of his laboratory to mix plaster or lime with seeds and that their germination is not impaired.

The influence of intermittent temperature on germination, J. VANHA (*Ztschr. Landw. Versuchw. Oesterr., 1 (1898), p. 91; abs. in Ann. Agron., 25 (1899), No. 11, pp. 559, 560*).—A report is given of experiments conducted with seed of *Poa pratensis*, in which different lots of seed were successively subjected to temperatures of 4, 11, 19, 27, and 35° C. for different lengths of time, varying from 4 to 16 hours per day. The beneficial influence of changing the temperature was noted whenever the temperature did not fall below 11° or rise above 35°. The best results were obtained by raising the temperature from 19 to 27°. The check experiments gave the best results at 27°, with 4° as the minimum and 35° as a maximum for germination. The results obtained with the checks were decidedly inferior to the others, and the best results were obtained in subjecting the seed to temperatures of 16, 22 to 27, and 34°, the last to be maintained for 4 or 5 hours per day.

According to the investigations of Liebenberg, intermittent temperature exercises a favorable action upon the genera: Poa and Agrostis, Dactylis, Anthoxanthum, Festuca, Alopecurus, Cynosurus, Daucus, Anethum, Ornithopus, Alnus, Betula, Beta, and conifers.

The vitality of seeds twenty years in the soil, W. J. BEAL (*Jour. Columbus Hort. Soc., 14 (1899), No. 3, pp. 113, 114*).—In a paper read before the Association for the Promotion of Agricultural Science at its meeting August 19, 1899, the author gives results of the examination of seeds that have been buried for 20 years in the soil. The seeds were placed in 8-oz. bottles, mixed with sand, and buried at a depth of 20 in., the open mouths of the bottles slanting downward. A previous report on a similar experiment covering 15 years (E. S. R., 6, p. 539) gave conclusions similar to those in the present article. The seeds of 22 species of plants, mostly weed seeds, were tested, 50 seeds being used in every case. At the end of 20 years the following kinds and number of seeds germinated: Buckwheat, 4; black mustard, 9; shepherd's purse, 21; wild-pepper grass, 29; evening primrose, 14; smartweed, 1; narrow-leaved dock, 8; chickweed, 3, and mullein, 16.

The destruction of charlock, J. A. VOELCKER (*Jour. Roy. Agr. Soc. England, 3. ser., 10 (1899), pt. 4, pp. 767-775*).—During the past season experiments were made over a considerable portion of Great Britain, in which spraying solutions of copper sulphate and iron sulphate for the destruction of charlock were tested. The author has brought together the reports of these experiments and summarized them.

In Northumberland and adjacent regions experiments on 17 different farms are reported in which preference was given to a 4 per cent solution of copper sulphate used at the rate of 40 gal. per acre. In Essex a 2 per cent solution of copper sulphate applied at the rate of 50 gal. per acre, in dry weather, when the plants were young, seemed to effectually destroy the weed without injury to other crops. It was sprayed upon crops of wheat, oats, barley, peas in bloom, cabbage, young clover, and tares, all of which were wholly uninjured; young peas, mangels, and beans were not permanently injured, but turnips were killed as quickly as the charlock.

Similar reports are given of experiments conducted at Cambridge, Sussex, Holmes Chapel, and Stamford, and a compilation is made of more than 200 additional trials throughout the country at large.

Summarizing all these experiments the author states that it can hardly be doubted that suitable spraying solutions are capable of destroying charlock to a very great extent when it occurs with other crops, without injury to the crops. Of spraying solutions, sulphate of copper is on the whole the best. Sulphate of iron is more uncertain and, though cheaper, requires a much larger quantity, so that the cost becomes about the same in either case. Successful spraying depends largely upon the conditions prevailing at the time. These are mainly the state of the weather and the age of the charlock. All experiments point to the conclusion that charlock should be sprayed in quite early stages, before the flower heads appear.

As regards the strength and quantity of solution opinions vary, but it appears that a 2 per cent solution at the rate of 40 gal. per acre will, as a rule, be successful in destroying the weeds when quite young, and a 3 or 4 per cent solution will be needed if the weeds are more advanced. The cost of materials and application will be from 75 cts. to $1 per acre.

How to test the vitality of garden seeds, A. S. Hitchcock (*Industrialist, 26 (1900), No. 19, p. 266*).—A brief description is given for the home testing of garden seeds, the method suggested being essentially that described in the Yearbook of this Department for 1895 (E. S. R., 8, p. 795). Appended is given a list of the average number of years that a number of the more common garden seeds will retain their vitality.

Seed testing, T. W. Kirk (*New Zealand Dept. Agr. Rpt. 1899, pp. 214-216*).—A tabular statement is given of the germinative ability of the seeds of a number of forage and other plants, in all about 150 tests being reported.

Tests of the vitality of grain and other seeds for 1898, W. Saunders (*Canada Expt. Farms Rpts. 1898, pp. 69-71*).—A report is given of 1,834 lots of seeds which were tested during the season of 1898 The average results of 6 years' testing of wheat, barley, and oats are given in tabular form, and the results of all the tests of seeds for vitality are tabulated. Tables are also given showing the results of grain tests for each of the Provinces.

Notes on weeds, T. W. KIRK (*New Zealand Dept. Agr. Rpt. 1899, pp. 222–227, figs. 3*).—Illustrated notes are given on pennyroyal (*Mentha pulegium*), which is said to be exceedingly troublesome on grass lands, nut grass, wild onion or sweet-scented garlic, bachelor's button, black nightshade, and native tobacco.

Weeds in pastures, T. W. KIRK (*New Zealand Dept. Agr. Rpt. 1899, pp. 216–218, fig. 1*).—Brief notes are given on the Canada thistle and the wild turnip. Experiments were conducted in which a 4 per cent solution of copper sulphate was sprayed at the rate of 25 gals. per acre over wheat and oat fields, and which resulted in killing the wild turnip without any injury to the crop. The same experiment is to be repeated on a larger scale.

The cocklebur, J. H. MAIDEN (*Dept. Agr. New South Wales, Misc. Pub. 332, pp. 5, pl. 1*).—Notes are given on the introduction and distribution of *Xanthium strumarium* in Australia, and its eradication by destroying the plants before seed maturity is advised.

The passing of the Russian thistle, C. E. BESSEY (*Jour. Columbus Hort. Soc., 14 (1899), No. 3, pp. 135–137*).—In this paper, which was read before the Association for the Promotion of Agricultural Science at its meeting in August, 1899, the author states that in a recent journey of nearly 1,000 miles through a region once badly infested by the Russian thistle he found this weed to be of relatively much less importance than formerly. On fallow ground it still grows large and assumes a spherical form, but ordinarily it is low and slender. On ordinary farms it is said that the weed finds little opportunity for troublesome growth. Many farmers and ranchmen are said to esteem it as a fodder plant when fed early, and the author believes that the time may come when the sheep growers on the plains will undertake growing the Russian thistle as a fodder plant.

DISEASES OF PLANTS.

The crown gall, J. W. TOUMEY (*Arizona Sta. Rpt. 1899, pp. 235–238*).—For several years crown gall of deciduous fruit trees has been under investigation at the station. Field work has been conducted in an almond orchard at Glendale, Ariz., while experiments on seedling almonds, peaches, apricots, apples, walnuts, plums, and grapes were carried on in the station forcing house. So far no organism has been found to which the disease can be attributed. Many fungi have been observed at various stages of growth, but apparently all are present as saprophytes. Nematode worms are found abundantly occupying the soft tissue of the gall after it has begun to develop, but they are never found in the young galls.

A number of experiments have been undertaken to determine the communicability of the disease, which practically prove its contagious character. In one experiment almond seeds were planted mixed with several pounds of minced galls placed in the drills; another lot was placed in a similar manner mixed with minced galls and an equal weight of sulphur; a third lot of seed was mixed with minced galls and one-half their weight of copper sulphate; and an equal number of seeds were planted as a check. In each plat about 40 per cent of the seeds grew. In plats where the seeds were planted with minced galls 16 trees were diseased; in plats where the seeds were mixed with minced galls and sulphur 17 trees were diseased; and in plats where the seeds were mixed with minced galls and copper sulphate only 1 tree was diseased. In the check there were no diseased trees.

In the second experiment 12 seedlings from the check plat of the previous experiment were cut back and reset in the plat in which they originally grew. Before setting each seedling was treated with a small portion of rapidly growing gall crushed and inserted in a wound made at the crown of the seedling. A month later 10 of the seedlings had developed galls at the point of inoculation, while the other 2 did not develop them during the year they remained in the plat.

In the third experiment 4 seedlings were taken from the second experiment which bore galls less than 2 lines in diameter. At the end of 2 weeks the galls had grown to nearly an inch in diameter. One seedling from the above lot, bearing a small gall, was placed in a glass jar with water coming to but not covering it. After growing for about 6 weeks the gall had increased more than 10 times its original size.

In another experiment a number of almond seedlings, which had come up in an orchard, were examined, and although less than 2 per cent of the total number of seedlings were diseased, it was found that more than 80 per cent of these were in contact with or were within 1 foot of galls on the old trees.

The author believes that his investigations indicate the communicability of this disease, but as yet the specific cause of it is unknown. Precautionary measures should be taken in planting to obtain seedlings from uninfested regions. The author's experiments indicate that copper sulphate is the most effective application to prevent the root or crown gall. He recommends mixing a given weight of pulverized copper sulphate with twice its weight in lime, to which sufficient water is added to make the mixture of the consistency of paste. Remove the galls and cover the wounds with a thick layer of the paste. All galls removed should be gathered and burned.

A bacterial disease of the sugar beet, CLARA A. CUNNINGHAM (*Bot. Gaz., 28 (1899), No. 3, pp. 177-192, pls. 5*).—Late in 1890 a chemist of the Indiana Experiment Station is said to have noticed that some sugar beets showed a much lower percentage of sugar than others, and the difference seemed to be associated with a slight change in the usual appearance of the roots. A preliminary study was made of the disease and the results published in Bulletin 39 of the station (E. S. R., 3, p. 853). In the fall of 1896 the author reinvestigated this disease and was led to believe that there is no positive evidence that the bacterial disease of sugar-beet in Indiana is the same as that described as occurring in Europe.

The disease attacks the whole beet plant, causing a peculiar appearance of the leaf, so that with a little practice diseased beets can be distinguished readily from healthy ones when growing in the field. The outer, older leaves soon die away, and the intermediate and heart leaves are left wrinkled, curled, rather flabby, and of a yellowish-green color. The external appearance of a diseased beet root is not materially different from that of a healthy one. A decisive test for the disease in the roots, however, is found in the appearance of the fibrovascular bundles, since in the diseased roots they appear as dark rings in the white flesh and become almost black after being exposed to the air for a few minutes.

An account is given of the experiments conducted for the separation of the organism causing the disease, and details of inoculation experiments. The germ as isolated is a small bacillus measuring from 0.9 to 1.3 μ and 0.5 to 0.8 μ in diameter. In culture media the germs are arranged singly or in pairs and possess individual motion. They are easily stained with all the common bacterial stains, but no method showed the presence of spores or flagella. The effect of light on growth and the growth of the germ in different culture media are described at length.

Summarizing the results of the experiments, the author states that microscopical examination of the tissues of diseased beets reveals the presence of bacteria in the cells of the plant. The tissues of the plant are not broken down and the bacteria in all parts of the plant seem to be the same. Transfers of diseased tissue to healthy beet roots resulted in a changed appearance of the plants, which indicated that the disease was transmitted.

The manner in which the germ finds entrance into the plant has not been determined. The conditions most favorable to attack are those resulting from drought with succeeding low temperature. Experiments have shown that in a medium containing a small quantity of acid the germ grows nearly or quite as well as in an alkaline one. It converts cane sugar to glucose, with the production of gas. The amount of gas produced does not seem to be constant, but the reasons for this irregularity are yet to be determined.

Another organism was separated from the sugar beet, which consisted of colorless, gelatinous masses resembling the Leuconostoc so common in the vicinity of sugar refineries. Microscopic examinations failed to reveal the characteristics of the Leuconostoc. If it should prove to be a form of this organism, its occurrence in diseased beet roots would be a matter of interest.

A new disease of carnations, L. MANGIN (*Compt. Rend. Acad. Sci. Paris, 129 (1899), No. 19, pp. 731–734*).—A description is given of a disease which has attacked carnations growing in the vicinity of Provence, Cannes, Nice, and Antibes. The diseased plants are recognized at once by the yellowish color and wilted condition of the leaves. The roots seemed sound, but the base of the stem is in a more or less advanced state of decomposition. The plants frequently rot off at the surface of the soil. Examinations of the tissues revealed a great number of fungi, among them being molds and a mycelium of a number of other fungi, bacteria, and eelworms, among them being Tylenchus and Rhabditis.

On account of the great number of possible causes, the author has examined them in considerable detail, and is led to the conclusion that the disease is due to the mycelium of some fungus, the exact nature of the parasite not being given. It seems probable that it is distributed through cuttings, and on this account it is recommended that before planting all cuttings should be placed for a short time in a solution of copper sulphate, 1 or 2 gm. per liter, or in a solution containing 15 gm. of naphthol and 45 gm. of soap per liter. By this operation all spores will be killed

Notes on plant diseases, T. W. KIRK (*New Zealand Dept. Agr. Rpt. 1899, pp. 227–231, pl. 1, figs. 2*).—Notes are given on the verrucosis of the lemon and other citrus trees, gooseberry-leaf spot, and gooseberry mildew, with suggestions as to the best remedies for combating them.

The black or summer rust of wheat, O. LUGGER (*Minnesota Sta. Bul. 64, pp. 535–550, figs. 13*).—A popular statement is given of the cause of the rust of wheat and its method of attacking the host, and the relation between the stages on the wheat and the barberry are shown.

Certain potato diseases and their remedies, L. R. JONES (*Vermont Sta. Bul. 72, pp. 32, figs. 17*).—This bulletin, which contains a résumé of the work done at the station in investigating certain potato diseases and their remedies in 1889–1899, is a revision and compilation from the previous publications of the station, especially of Bulletin 19 (E. S. R., 8, p. 138) and the report for 1895 (E. S. R., 8, p. 992).

A new potato disease, H. MARSHALL WARD (*Trans. British Mycol. Soc. 1897–98, pp. 47–50*).

A scab disease of sugar beets, FRANK (*Braunschweig. Landw. Ztg., 67 (1899), No. 51, pp. 228, 229, fig. 1*).—A characteristic disease is described in which the sugar beets are infested in rather definite zones with a deep scab formation. The cause of the disease is thought to be a species of Tylenchus.

A bacterial disease of the lupine, D. HEGYI (*Kiserlet. Közlem., 2 (1899), No. 5, pp. 232–235, figs. 2*).—Describes *Bacillus elegans*, n. sp., as causing a serious disease of lupines.

Bacteriosis of the tomato, D. HEGYI (*Kiserlet. Közlem., 2 (1899), No. 5, pp. 230, 231, figs. 2*).—Describes *Bacillus lycopersici* as causing a rot of tomato fruits, etc.

Combating the leaf diseases of orchard trees, grapes, etc., E. JOKISCH (*Mitt. K. K. Gartenbau Gesell. Steiermark, 1899, No. 6, pp. 115, 116*).

Grape anthracnose, T. W. KIRK (*New Zealand Dept. Agr. Rpt. 1899, pp. 219–222, pl. 1*).—Illustrated notes are given of the grape anthracnose due to *Sphaceloma ampelinum*, and the best remedies for prevention are suggested. Formulas and directions for the preparation of Bordeaux mixture and copper carbonate solution are given.

Anthracnose of grapes, J. M. HEURGO (*Minn. Agr. Argentine Republic, 1899, pp. 28, pl. 1, figs. 4*).—Describes the cause of the disease and suggests the use of fungicides for its prevention.

A disease of plane trees in the Luxemburg Gardens, A. GIARD (*Compt. Rend. Soc. Biol., 11. ser., 1 (1899), No. 23, pp. 565, 566*).—An attack of *Glœosporium* sp. is described.

Concerning the parasitic fungus which causes the wart disease of Japanese pines, M. SHIRAI (*Bot. Mag. [Tokyo], 13 (1899), No. 147, pp. 153–158*).

On the use of weak solutions of copper sulphate as a fungicide, G. BATTANCHON (*Vigne Amér. et Viticult. Europe, 23 (1899), No. 3, p. 72; abs. in Centbl. Bakt. u. Par., 2. Abt., 5 (1899), No 22, pp. 789, 790*).—The author states that at least 10,000 tons of copper sulphate has been used as a fungicide in the Department of Hérault. He believes that weaker solutions both when used alone and in Bordeaux mixture would be as efficient, cheaper, and often prevent the serious injury of too strong solutions.

Copper fungicides used at Montportail, F. SIMONET (*Vigne Amér. et Viticult. Europe, 23 (1899), No. 5, p. 152; abs. in Centbl. Bakt. u. Par., 2. Abt., 5 (1899), No. 22, p. 790*).—According to the abstract the efficiency of the fungicides for the prevention of Peronospora and black rot as shown by several years' testing was in the following order: Bordeaux mixture with sugar, Lavergne mixture, Bordeaux mixture with albumin, simple Bordeaux mixture, Burgundy mixture, bicarbonate of soda mixture, neutral verdigris solution, and Bordeaux mixture and molasses.

Notes upon injury to fruit trees caused by fungicides, F. MÜLLER (*Prakt. Bl. Pflanzenschutz, 2 (1899), No. 9, pp. 65-67*).

ENTOMOLOGY.

Report of the entomologist and botanist, J. FLETCHER (*Canada Expt. Farms Rpts. 1898, pp. 167-219*).—The author gives a somewhat extended discussion of the insects injurious to cereals. The wheat midge (*Diplosis tritici*) is reported as having caused considerable damage during the past year. The remedies suggested are the burning of all rubbish and deep plowing.

Biological notes are given of the Hessian fly (*Cecidomyia destructor*). The remedies to be relied upon are late sowing, burning of refuse, destruction of the stubble, and the application of a quick-acting fertilizer.

The wheat stem maggot (*Meromyza americana*) is described and figured. Three broods appear annually in the region of Ottawa, one at the beginning of June, the second at the end of July, and the third at the end of September. The author recommends the application of special fertilizers as a top-dressing, the sowing of a few drills of wheat or barley along the infested fields as trap crops, and the destruction of these trap crops.

The author gives biological and economic notes on the American frit fly (*Oscinis carbonaria*), with which the wheat stem maggot and Hessian fly are compared in both the larval and pupal conditions, jointworms (Isosoma), grain aphis, the wheat stem sawfly (*Cephus pygmæus*), and various species of cutworms.

The Rocky Mountain locust is described and figured. The author relates the various features of the life history and habits of this insect with references to the literature on the subject. The remedies to be applied are deep plowing in the spring or fall of the areas where the eggs are laid and the use of hopper dozers.

Among insects injurious to vegetables the author gives an account of 2 species of cutworms. The black army worm (*Noctua fennica*) is said to have committed serious depredations upon garden and field crops. The remedies which were successfully tried and are recommended are the same as those applied against outbreaks of the true army worm. *Carneades scandens* were found in large numbers in gardens in Ottawa. Brief notes are given on the habits of this species. As remedies against this insect the author recommends the banding of freshly set out annual plants with paper or tin rings and the use of poisoned bran which consists of a mixture of Paris green and bran in the proportion of 1:50. *Calosoma calidum* is mentioned as an especially destructive enemy of these cutworms.

Observations were made on the habits and life history of the pea moth (*Semasia nigricana*), pea weevil, bean weevil, carrot rust fly (*Psoila rosæ*), *Aphis brassicæ*, and the cabbage-root maggot. As a remedy for controlling the carrot rust fly, the author recommends spraying with kerosene emulsion, or sprinkling along the rows with a land plaster or ashes mixed with dry sand.

The four-lined leaf-bug (*Pœcilocapsus lineatus*) is reported as having been especially destructive to potatoes. The remedies which are recommended are kerosene emulsion as a spray upon the nymphs, jarring the nymphs and perfect insects from the plants into open tins containing kerosene oil, and the destruction of the eggs which are laid on the twigs of the bushes.

The apple-fruit miner (*Argyresthia conjugella*) is recorded as still doing considerable damage in parts of British Columbia. Brief notes with recommendations on the usual remedies are given for *Grapholitha prunivora*, tent caterpillars (*Clisiocampa disstria* and *C. americana*), plum curculio, species of Xylina, San José scale, cherry aphis, green apple aphis, and the bronze apple tree weevil (*Magdalis ænescens*).

Xylocrius agassizii is reported as having been introduced from Oregon into Victoria and to have attacked the stems of the gooseberry. Its native food plants are the various species of Ribes. The insect is rare even in its home on the Pacific slope, and the author does not fear that it will become of serious economic importance. A general account is added on the necessity of spraying and upon the benefits to be derived from it.

J. Fixter makes a report on various experiments conducted in the apiary. Eight colonies of bees were wintered in a cellar upon shelves. The front entrances of the hives were left wide open, and the wooden covers were taken off and replaced with chaff. The temperature during the winter varied from 44 to 50° F. The bees lost on an average 9 lbs. per swarm during the winter. Two colonies which were placed in the cellar with the tops and bottoms left on, lost 14½ lbs. per hive and the combs were found to be damp and slightly moldy in the spring. Two colonies stored in a root house, with as much ventilation as it was possible to give them under the circumstances, lost 13 lbs. per hive, and there were some signs of dampness in the hives as well as dysentery among the bees. Two colonies were put into a pit on the side of a hill on November 12. From November to March the temperature did not fall below 38° nor go above 39°. The pit was opened March 26. Water had accumulated so as to come up on the sides of the hives. One hive survived, the other finally died out. Two colonies which were left in the house apiary with some additional packing flew quite extensively during warm days and lost 19½ lbs. and 16½ lbs., respectively, during the experiment.

In some experiments made with full sheets of foundation and half sheets it was found that the bees in every case worked first on the full sheets.

The entomologist gives a brief description of the horn fly (*Hæmatobia serrata*) with the recommendation of the following remedy: A mixture of 1 lb. of pine tar in 10 lbs. of lard.

The Hessian fly, O. LUGGER (*Minnesota Sta. Bul. 64, pp. 551–557, figs. 5*).—In this bulletin the author has summarized our present knowledge on the subject of the habits and life history of the Hessian fly. The remedies which have already been found more or less effective in controlling this insect are recommended for use. From certain observations which the author has made in Minnesota, it is believed that the insect in that State develops only one brood per year. Since the author believes that the Hessian fly in Minnesota passes the winter in the flaxseed stage, he recommends, especially, burning of the stubble where this is possible, and in case this remedy is not practicable, it is recommended that all wheat-stubble ground be plowed. The plowing should be done very soon after harvesting. A few of the parasites which are known to help in reducing the numbers of the Hessian fly are figured and briefly described.

Migratory locusts, or grasshoppers, O. LUGGER (*Minnesota Sta. Bul. 64, pp. 558–569, pls. 2, figs. 8*).—This article contains a popular account of the habits and of the devastation which is wrought by migratory locusts, dealing especially with 3 species, the Rocky Mountain locust, the lesser migratory locust (*Melanoplus atlanis*), and *Camnula pellucida*. The author briefly describes the method of egg-laying which is peculiar to the Rocky Mountain locust, and also mentions the situations in which the lesser migratory locust usually deposits its eggs The pellucid locust has rather different egg-laying habits. Ordinarily the eggs are deposited upon the surface of the soil, and are protected by grass and such rubbish as may be found in those situations. Occasionally the eggs are laid just beneath the surface, but this occurs only where the soil is loose.

The author describes certain features of these 3 species by means of which they can be identified. With regard to remedies, it is recommended that all cultivated ground, and especially stubble fields which are selected by the locusts for deposition of their eggs, be thoroughly plowed.

Some important insect enemies of cucurbits, A. L. QUAINTANCE (*Georgia Sta. Bul. 15, pp. 21–50, figs. 17*).—In this bulletin the author has given a general discussion of the habits, life history, distribution, natural enemies, and remedial and preventive measures of the following insects: Striped cucumber beetle (*Diabrotica vittata*), melon aphis (*Aphis gossypii*), pickle worm (*Margaronia nitidalis*), melon worm (*M. hyalinata*), the squash-vine borer, and the squash bug.

In studying the pickle worm, bottomless cages were placed over vines and fruits in the field in order to secure the most natural conditions. The insects deposited their eggs upon the glass and the woodwork of the breeding cages. No eggs were laid on the foliage or fruit of the canteloupes upon which the experiments were made. The eggs hatched in about 3 days and during warm weather the larvæ completed their growth within 14 days. The larvæ seemed to prefer the flowers and fruit of the squash.

In experiments made in the field, tobacco dust, pyrethrum powder, hellebore, carbolized lime, and a thick coating of Bordeaux mixture proved valueless. It is suggested that some protection may be secured by planting squash as a trap crop.

The author found that the melon worm appears in some seasons about June 15, and in other seasons as late as July 17. It is believed, therefore, that correspondents may have mistaken the pickle worm for the melon worm.

The moths of the squash-vine borer were observed as early as May 23 and as late as July 22. There seem to be 2 broods in the State each year, and the life cycle is about 2 months.

The forest tent caterpillar, V. H. LOWE (*New York State Sta. Bul. 159, pp. 33–60, pls. 6*).—In this bulletin the author presents an account of the systematic position of the tent caterpillar, a brief statement of the origin and distribution of the insect, and of the history of our knowledge concerning it. The first disastrous outbreaks of this insect in New York were in 1866 and 1867. In 1886, and again in 1889 and 1890, the insect was present in destructive numbers. In 1893 another outbreak occurred, especially in apple orchards. The outbreak of which this bulletin is an account was felt most severely along the western, northern, and eastern portions of the Adirondacks, the upper valley of the Hudson, and throughout Cortland, Chenango and Otsego counties. Besides the food plants upon which this insect has already been reported as depredating, the author adds ironwood to the list. Brief descriptions are given of the egg and the egg masses. It is stated that the latter were not as large as usual, containing as a rule only about 200 eggs. The eggs were laid the last week of June and the first week of July. The earliest caterpillars were seen about Geneva during the last week of March. The period of hatching extends over a month or more, and under normal conditions the caterpillars acquire their full size within 6 weeks. The author describes the feeding habits and the silk-spinning habit of the caterpillars. The forest tent caterpillar was observed sharing a nest with an apple-tree tent caterpillar. The first-named species, however, was never seen to enter the nest. The congregating habit of the caterpillar at times of molting is noted, and detailed descriptions are given of the caterpillars during their different stages between the molts. This insect usually pupates inside of rolled leaves, but it was observed to pupate in large numbers on fences, out-buildings, and even on the ground. The moths issued from the cocoons from June 26 until July 8. Two thousand five hundred cocoons were collected for observation. Out of this number, 794 produced male moths and 672 female moths; 312 of the cocoons were parasitized, and 722 did not hatch. It is thus seen that about 40 per cent of the cocoons failed to produce moths, and a little over 12½ per cent were parasitized The author reproduces detailed descriptions of the male and female moths as given by Dr. Fitch.

Among the birds which are reported as preying upon this insect may be mentioned the black-capped chickadee, yellow-billed cuckoo, Baltimore oriole, American red start, catbird, and robin. The more noteworthy insect enemies of the forest tent caterpillar include the following predaceous species: *Calosoma scrutator*, *C. calidum*, *Podisus placidus*, and *P. seriventris*. Among the parasitic insects which were bred from the cocoons we may note the following: *Pimpla conquisitor*, *P. pedalis*, *Theronia fulvescens*, and *Diglochis omnivorus*.

By way of artificial remedies against this insect the author recommends the following measures to be adopted: The destruction of the egg masses, spraying with an arsenical compound for poisoning the caterpillars, the destruction of the caterpillars while assembled in masses on the trunks and large branches, and the method of jarring and banding. For banding the tree the author recommends tar mixed with two parts of raw oil or raupenleim. The moths are readily attracted to the light and may thus be caught by a lantern trap. It may be advisable to collect the cocoons, but if this is done they should not be destroyed, but should be placed under a netting with meshes of such size as to allow the parasites to escape, but to prevent the escape of the moths. For spraying the larger shade trees it will be found advisable, where it can be afforded, to use steam power apparatus. A rather extensive bibliographical list of literature on this insect is appended to the bulletin.

The cherry fruit fly—a new cherry pest, M. V. SLINGERLAND (*New York Cornell Sta. Bul. 172, pp. 21-41, figs. 7*).—The larva of the fly, which is believed by the author to be *Rhagoletis cingulata*, has been found infesting cherries in one orchard of Massachusetts and in several of New York. The mature flies have not yet been bred from these maggots, and the provisional identification by the author may therefore prove to be incorrect. Adult flies of the species to which the larva are referred were noticed in considerable numbers about the cherry trees and upon the cherries. These flies were not observed depositing eggs nor were uninjured eggs secured for study. It is believed that the eggs are deposited either upon the skin of the cherry or just beneath the surface. The maggots feed upon the flesh of the ripening cherry near the pit. Ordinarily there is but a single maggot in each cherry, but occasionally a second smaller one was found. This pest attacks all varieties of cherries, whether sweet, sour, subacid, early, or late. One unfortunate feature of infestation by this insect is that the presence of the maggots within the cherries can not be surmised from the external appearance of the fruit. The insect has been reported from Belmont, Mass., Ithaca and Geneva, N. Y. Some cherry growers noticed this insect in their fruit last year, and the correspondent from Belmont, Mass., believes that his fruit has been infested for 4 or 5 years. From the incomplete observations which have been made upon the insect thus far it is believed there is only one brood per year.

No remedial measures have been undertaken as yet, but the author presents a summary of operations which have been conducted in Australia, South Africa, and Europe in the destruction of these insects. A brief bibliography of the subject is appended to the bulletin.

Second report of the State inspector for the San José scale, W. B. ALWOOD (*Richmond, 1899, pp. 34, map 1*).—This report contains a statement of the law according to which the State inspector of Virginia was appointed and of the rules and regulations for the government of the inspector and assistant inspectors in their work on the eradication of the San José scale. The inspection work thus far conducted in the State indicates the presence of the San José scale in 318 localities scattered over 36 counties. Tables are given showing the location of the different infected areas and the source from which the infection came. The author believes that the work of inspection in Virginia has materially lessened the distribution of the scale by means of interstate commerce. Attention is called to the necessity of thorough inspection and eradication methods in nurseries which have once become badly infested. Sixty-nine nurseries within the State have been inspected, and treatment against the San José scale has been carried out in the 9 nurseries which were found infested, with the result that the scale has apparently been eradicated in 5.

In experimental work with remedies against this insect, the author made use of all the better known remedies. For fumigation hydrocyanic-acid gas was produced according to the following formula: Fused potassium cyanid, 98 per cent, 1 oz.; commercial sulphuric acid, 1⅛ fluid oz.; water, 3 fluid oz. for each 100 cu. in. of space. It is stated that this formula is slightly stronger than is necessary, but is entirely safe with dormant plants.

A report is made on experiments conducted in one orchard which consisted of about 400 apple trees. Apparently the San José scale in this orchard had gradually spread from 4 original centers of infestation. The course of the distribution of the scale was in the direction in which the orchard was cultivated, and it is suggested that the spread of the scale, therefore, depended upon human agencies. The orchard was divided, for experimental purposes, into 3 sections, of which one was treated with Leggett's whale-oil soap, another with kerosene, and a third with Good's potash soap. Leggett's soap in the proportion of 2 lbs. to a gallon of water was applied March 12. It was applied at a temperature of 135° F. On December 24 of the same year, an inspection of this section of the orchard showed that the trees were in good condition and that the scales were all dead.

Upon the second section pure kerosene was sprayed on March 21 by means of a blast atomizer. The buds of the trees were swollen at the time. On March 28, the same trees were sprayed with a 30 per cent kerosene-water mixture. On December 24 of the same year an examination of these trees showed that the scales were dead and that no apparent injury had resulted to the trees.

Good's No. 3 soap was applied to section 3 in the same manner and at the same dates as in the treatment for section 1. An examination of this section of the orchard on December 24 of the same year disclosed the fact that the scales were apparently all dead and that all trees had escaped injury except one which would apparently die. On November 4 of the following year living San José scale were found upon one tree which had been treated with kerosene.

It was found impracticable during these experiments to apply by means of a spray machine any soap solution which contained 2 lbs. of soap to a gallon of water. At this strength the solution is too caustic and destroys the hose. The kerosene method is believed to be very effectual and is much the cheapest method of the three.

The San Jose scale law in Virginia empowers cities or counties to take special action regarding the extermination of the scale. Such action has been taken in a few cases and the author believes it is a valuable provision in the law. A list of plants which are known to serve as host plants for the San Jose scale is given, together with a list of publications of the Virginia Station and State inspector relative to the San José scale.

Crude petroleum as an insecticide, J. B. SMITH (*New Jersey Stas. Bul. 138, pp. 22, pls. 1*).—The use of crude petroleum as an insecticide was first suggested to the author by L. P. Schenck in the winter of 1897–98. This substance was believed to be dangerous to fruit trees and was therefore experimented with rather cautiously at first. A dwarf Duchess pear tree which was thickly incrusted with San José scale received an application of crude petroleum in January, 1898. All scales were destroyed and the tree remained uninjured. In March, 1898, the section of the orchard in which this tree stood was treated with a 30 per cent crude oil mixture. The growth of the trees seemed to be stimulated and no trace of injury from the insecticide was manifested. On March 15, a dozen pear trees in early stages of growth were sprayed. In this experiment some injury was produced, a few of the twigs being killed outright. As a winter application the insecticide had proved thus far very satisfactory. The author now requested certain horticulturists to make experiments as checks upon his own work. Henry Pfeiffer made application of crude petroleum to peach trees in a series of sprayings. The insecticide was applied March 27, 31, and April 14 and 28. No injury to the trees was produced by these applications. In another location 600 peach trees which were moderately infested with scale were sprayed with a 30 per cent mixture of crude petroleum and water during March. The scales were killed and the trees did not suffer from the application. Fifty gallons of oil were used upon the 600 trees and application was made by means of the Vermorel nozzle. Three peach trees which were sprayed early in April with 6 qts. of crude oil were freed from the San José scale by this application but were killed by the insecticide.

Currants, gooseberries, raspberries, and blackberries were sprayed with 30 per cent crude oil without injury to the plants. A number of young apple trees in the nursery row had become badly infested with San José scale and were taken out and painted with undiluted crude oil by means of a whitewash brush. The scales were all killed and the trees were without injury. Similar results were obtained in a plum orchard of 100 trees which was sprayed with undiluted oil.

Satisfactory experiments are reported from the use of an emulsion of crude petroleum made according to the following formula: Olein soap, 8 lbs.; crude petroleum, 40 qts.; water, 40 qts.

In all about 1,000 trees other than cherry were treated with crude petroleum either undiluted or mixed with from 60 to 70 parts of water. These trees varied in age from stock in the nursery row to old trees in full bearing. No cases of injury were reported from applications which were made in the winter. On the contrary, the trees seemed to show increased vigor. The fruit buds were not found to have been injured, although the observations on this point were not complete. The author concludes that crude petroleum is not suitable as a summer application, either pure or undiluted. This substance does not evaporate readily, and on small branches it ultimately passes around the whole branch, even when during the application it only touched one side. It does not usually penetrate through the superficial layer of bark, yet it remains as an oily covering for some weeks and the San José scale can not penetrate, even after the application has been upon the tree for a month. The author believes that crude petroleum is as effective in the destruction of scale insects as kerosene and that it is harmless even to the more tender varieties of fruit trees. It is recommended that when the oil is used in an undiluted form it should be applied with a Vermorel nozzle. Equally satisfactory results are obtained, however, when the crude oil is used mixed with from 60 to 75 per cent of water. Summer applications of the oil may be made upon the trunks and branches if care is exercised that the oil does not come in contact with the foliage. Close observation must be kept upon the emulsion sprayers, if such machines are used. It is found that they are often unreliable, throwing at times almost undiluted oil and at other times almost pure water.

Methods of producing honey, F. Greiner (*Trans. New York State Agr. Soc. and New York Bureau Farmers' Inst. Rpt. 1898, pp. 300–306*).—A discussion of the most suitable arrangement of frames and hives for a large production of honey.

Foul brood in bees, E. R. Root (*Trans. New York State Agr. Soc. and New York Bureau Farmers' Inst. Rpt. 1898, pp. 307–314*).—An account of the nature of foul brood, with a statement of treatment to be adopted against it. The laws of Wisconsin and New York regarding foul brood are appended to the article.

The respiratory products of the egg of the silkworm during normal incubation, E. Quajat (*Ann. R. Staz. Bacol. Padova, 27 (1899), pp. 57–81, pls. 2*).—An experimental study of this problem under various conditions of incubation, such as incubation with rapid and constant elevation of temperature, incubation in dry and humid atmosphere, and slow and gradual incubation with a comparison of the behavior of different races of silkworms under these conditions.

The influence of external conditions upon the physical properties of the cocoon of silkworms, E. Verson (*Ann. R. Staz. Bacol. Padova, 27 (1899), pp. 93–96*).

On the wintering and incubation of the egg of the silkworm, E. Quajat (*Ann. R. Staz. Bacol. Padova, 27 (1899), pp. 13–43*).—An experimental study of the following problems: The influence of estivation or of a long preparatory stage upon the duration of the period of hibernation, and a determination of the minimum time necessary for complete hibernation.

The action of "epicarin" upon the mange mites of dogs, Regenbogen (*Monatsh. Prakt. Thierh., 11 (1900), No. 4, pp. 145–149*).—This substance was found by experiment to have only a slight effect upon the mites.

The color relation between the pupæ of Papilio machaon, Pieris napi, and many other species and the surroundings of the larvæ preparing to pupate, F. Merrifield and E. B. Poulton (*Trans. Ent. Soc. London, 1899, pt. 4, pp. 369–433*).—A detailed account of experimental studies upon the interrelation between insects and their environments with regard to the influence of the intensity of light and the color of environment upon the color of the insects.

On sexual dimorphism in the rutelid genus Parastasia with descriptions of new species, G. J. Arrow (*Trans. Ent. Soc. London, 1899, pt. 4, pp. 479–499 pl. 1*).—An account of the striking differences in size and occurrence of the two sexes of the species belonging to Parastasia.

Dimorphism in the two sexes of a new species of Cecidomyidæ, J. C. H. De Meijere (*Tijdschr. Ent., 42 (1899), No. 3, pp. 140–152, pls. 2*).—A study of this phenomenon in a species of Monardia.

On the metamorphosis of insects, C. Perez (*Bul. Soc. Ent. France, 1899, No. 20, pp. 398–402*).—A study of the action of the leucocytes in ants and Tineidæ during metamorphosis.

The ants of Madagascar collected by A. Mocquerys, C. Emery (*Bul. Soc. Ent. Ital., 31 (1899), No. 1–4, pp. 263–290, figs. 8*).—Descriptive and biological notes upon a number of species, some of which are here described for the first time.

The visitors of the Caprifoliaceæ, J. H. Lovell (*Amer. Nat., 34 (1900), No. 397, pp. 37–51*).—Notes on the insect visitors of a number of species belonging to this family of plants.

Hop dogs, F. V. Theobald (*Jour. Southeast. Agr. Col., Wye, 1899, No 8, pp. 35–38*).—Economic and biological notes on *Dasychira pudibunda*, *Orgyia antiqua*, and *Porthecia auriflua*.

Injurious fruit insects, R. Goethe (*Ber. K. Lehranst. Obst., Wein u. Gartenbau, Geisenheim, 1898–99, pp. 16–24, figs. 3*).—Notes on *Aspidiotus ostreæformis*, *A. scutiformis*, *Diaspis fallax*, species of Parlatoria, *Schizoneura lanigera*, and *Anthonomus pomorum*.

Fruit flies, T. W. Kirk (*New Zealand Dept. Agr. Rpt. 1899, pp. 232–234, figs. 7*).—Notes on *Tephritis tryoni* and *Halterophora capitata*.

The "cankerworm," G. Allen (*Sci. Amer. Sup., 49 (1900), No. 1255, pp. 20122–20124, figs. 19; reprinted from the Strand Magazine*).—A popular account of the periodical cicada and the army worm.

Experiments in fighting the woolly aphis, Schellenberger (*Fühling's Landw. Ztg., 48 (1899), No. 18, pp. 696, 697*).

A pest of woodland and grove, F. H. Hall and V. H. Lowe (*New York State Sta. Bul. 159, popular ed., pp. 6, figs. 3*).—This is a popular summary of Bulletin 159 of the station (E. S. R., 11, p. 865).

The destructive green-peà louse, W. G. Johnson (*Canad. Ent., 32 (1900), No. 2, pp. 56–60, figs. 3*).—Notes on the habits and life history of *Nectarophora destructor. Bassus lætorius* was bred from this insect. Ladybirds, Syrphus flies, and lacewings were observed as predaceous enemies of the louse.

The insect foes of tobacco (*Sci. Amer. Sup., 49 (1900), No. 1257, pp. 20146, 20147 figs. 5*).—Notes on *Protoparce celeus, Epitrix parvula, Heliothis armigera, Lasioderma serricorne, Œcanthus niveus*, and other insects injurious to tobacco.

A new insect pest, J. Chamberlain (*Sci. Amer., 82 (1900), No. 3, p. 42*).—An account of the damage done to white birch by *Agrilus anxius* in Buffalo and vicinity.

Notes and descriptions of some species of western Australian Coccidæ, C. Fuller (*Trans. Ent. Soc. London, 1899, pt. 4, pp. 435–473, pl. 1*).—Notes upon about 100 species of Coccidæ, with descriptions of some new species.

Cyclopodia horsfieldi, a new species of Nycteribiidæ from Java, J. C. H. De Meijere (*Tijdschr. Ent., 42 (1899), No. 3, pp. 153–157, fig. 1*).—A description and notes on the habits of this species which was found on *Pteropus edulis*.

Ephestia kuehniella V. Mayet (*Prog. Agr. et Vit. (Éd. L'Est), 21 (1900), No. 1, pp. 30, 31*).—Brief notes on the habits and life history of and remedies against this insect.

Heliothis armigera (*Rpt. Govt. Gardens and Parks in Mysore, 1897–98, pp. 17–20*).—A list of plants which are attacked by this insect, with recommendation of well-known remedies.

Revision of the Lathridiidæ of boreal America, H. C. Fall (*Trans. Amer. Ent. Soc., 26 (1899), No. 2, pp. 101–190, pls. 3*).—A monograph of this family of beetles, with notes on the habits of the various species.

Lecanium viride and its extermination, H. Potel (*Bol. Inst. Agr. São Paulo, 10 (1899), No. 8, pp. 464–468*).—A description of the insect, with an account of its habits and life history, and brief notes on remedies for its control.

A new species of plant louse injurious to violets, T. Pergande (*Canad. Ent., 32 (1900), No. 2, pp. 29, 30*).—Describes as new, under the name *Rhopalosiphum violæ*, a species of plant louse which is quite generally distributed in the United States and Canada, and which attacks violets, especially in greenhouses.

The purslane sawfly (Schizocerus zabriskei), F. M. Webster and C. W. Mally (*Canad. Ent., 32 (1900), No. 2, pp. 51–54, figs. 3*).—The eggs are deposited on the edge of the leaves of the common purslane. The insects pupate in the soil at a depth of about 1 in. The entire life cycle occupies about 3 weeks, and there are probably 6 generations in a year. This sawfly is parasitized by a species of Ichneutes.

A plum-tree disease Prillieux and Delacroix (*Bul. Mens. Soc. Cent. Agr. Hort. et Acclim. [Nice], 39 (1899), No. 12, pp. 215, 216*).—A description of the work of Scolytid beetles.

Sitotroga cerealella, V. Mayet (*Prog. Agr. et Vit., 16 (1899), No. 53, pp. 773–777*).—A description of the insect is given, with an account of its geographical distribution. The remedies which are recommended by the author are the application of heat and the use of a machine through which the grain is passed and in which the insect is said to be killed by a mechanical shock. The machine can be operated by two men and consists essentially of a cylinder within a cylinder, both furnished with metallic projections upon their opposing surfaces in such a manner that when the machine is in motion, the grain and insects are subjected to repeated mechanical shocks.

Tortrix ambiguella and means of combating it, J. Perraud (*Prog. Agr. et Vit. (Éd. L'Est), 21 (1900), No. 2, pp. 40–42, pl. 1*).—Brief notes on the habits of this insect and remedies to be applied against it.

FOODS—ANIMAL PRODUCTION.

The proteids of wheat flour, H. SNYDER (*Minnesota Sta. Bul. 63, pp. 519–533*).—The author gives a somewhat exhaustive review of the subject of the chemistry of wheat proteids, and reports a study of the proteids of a number of samples of wheat flour and other milling products. The principal conclusions follow:

> "In the milling of wheat a partial mechanical separation of the various proteids takes place. The germ proteids are composed largely of albumin and globulin bodies, while the bran and shorts contain only about 50 per cent of the total nitrogen in the form of gliadin and glutenin. The removal of the bran shorts and germ from the flour in the process of milling results in an increase in the gliadin-glutenin content of the flour, the nongluten proteids being removed mainly in the offal products.
>
> "In the patent flour from soft winter wheat 73.90 per cent of the total nitrogen was in the form of gliadin, while in the patent flour made from hard winter wheat an average of 63.68 per cent of the total nitrogen was in the form of gliadin. The sticky character of the dough of the soft wheat was probably due to an excess of gliadin, and a deficient amount of glutenin. A well-balanced gluten is composed approximately of 65 per cent gliadin and 35 per cent glutenin.
>
> "The gliadin-glutenin ratio in the different grades of flour made from the same wheat varies from 25 to 75 in the Red Dog, to 65 to 35 in the highest patent. The lower grades of flour contain appreciably more protein than the higher grades, but the gliadin and glutenin in the lower grades are not present in the right proportion to form a well-balanced gluten, capable of expansion, and able to produce bread of the best physical properties."

Physical properties of nuts, C. P. FOX (*Agr. Education, 2 (1899), No. 1, pp. 17–19*).—The author reports a number of physical determinations made with different nuts in the laboratory of W. R. Lazenby of the University of Ohio. These include the number of nuts to the pound, the percentage of kernel to shell, and loss of nuts in cracking. The comparative money value of nuts was also tested. Filberts and peanuts gave the largest number of nuts to the pound. The percentage of kernel to whole nut was highest in the American chestnut and lowest in large hickory nuts. The loss in cracking nuts was found to be about 4 per cent, one half of this being kernel. "If we lay aside the peculiarities of individual taste and consider the matter from a true financial basis, we find that shellbark hickory nuts at 2 cts. a pound and walnuts at 1 ct. a pound are the cheapest. Of the true commercial nuts the peanut at 5½ cts. a pound is the most economical.

Lemon flavoring extract and its substitutes, A. S. MITCHELL (*Jour. Amer. Chem. Soc., 21 (1899), No. 12, pp. 1132–1137*).—The author examined a number of samples of lemon flavoring extract in the course of work for the Wisconsin Dairy and Food Commission. The methods followed are described in some detail.

> "A preliminary examination of the extracts supplied by grocers showed them to contain alcohol in amounts varying from 14 to 94 per cent by weight and oil of lemon from 0 to 8 per cent.
>
> "The extracts low in alcohol had in many cases a fine aroma derived from agita-

tion with new oil of lemon in some cases but more frequently produced by citral and the so-called 'soluble oil of lemon,' or from lemon-grass or citronella aldehyde and frequently with the addition of tincture of nutmeg, mace, or capsicum. The cheaper grades contained so little oil in solution that the addition of water frequently failed to produce turbidity."

Forage plants, fodders, and feeding stuffs, F. T. SHUTT (*Canada Expt. Farms Rpts. 1898, pp. 112–151*).—The composition is reported of hay from a number of native grasses from "uplands and low lands" in Manitoba and the Northwest Territories, timothy and brome grass hay, soy-bean forage, oat shorts, oat dust, oat-meal dust, oat screenings, molasses refuse or sirup, and cocoa shells, the latter analysis including fertilizer constituents. The hay from the native grasses and sedges included *Carex aristata* and *C. stricta; Deyeuxia neglecta* and *Carex stricta*, 1:1; *Carex straminea; Poa pratensis, P. serotina*, and *Phleum pratense; Deyeuxia confinis* and *Hordeum jubatum; Festuca (Fluminia) arundinacea* (white top); *Festuca scabrella, Agropyron glaucum*, and *A. caninum; A. glaucum, A. caninum*, etc., and weeds; and *Sporobolus cuspidatus*. The composition of a number of these follows:

Composition of hay from Manitoba and the Northwest Territories.

Name.	Water	Protein.	Fat.	Nitrogen-free extract	Fiber.	Ash	Albuminoids.
	Per cent	*Per cent.*	*Per cent*	*Per cent*	*Per cent.*	*Per cent.*	*Per cent*
Deyeuxia neglecta and *Carex stricta*, 1:1	6.28	10.00	3.52	45.49	28.30	6.41	10.62
Carex straminea	6.38	7.06	2.51	49.41	29.52	5.12	7.50
Festuca (Fluminia) arundinacea (white top)	7.20	6.75	2.24	43.61	34.18	6.02	7.25
Deyeuxia confinis	6.65	7.00	2.75	41.52	35.88	6.20	7.50
Carex aristata	6.95	9.00	3.10	47.27	26.03	7.65	9.69
Sporobolus cuspidatus	6.33	5.94	2.82	49.39	28.62	6.90	6.31

The comparative value of upland and lowland hay is discussed.

The two samples of molasses refuse examined had the following composition:

Composition of molasses refuse.

	Water.	Protein	Nitrogen-free extract.	Cane sugar.	Glucose	Ash.
	Per cent.	*Per cent*	*Per cent.*	*Per cent.*	*Per cent*	*Per cent.*
Sample No. 1	24.89	7.81	5.98	50.27	1.95	9.10
Sample No. 2	26.42	6.85	3.10	50.05	5.00	8.58

This crude sirup cost ¾ ct. per pound and, in the author's opinion, should prove a profitable feeding stuff. It is stated that from 2 to 4 lbs. can be fed per head daily economically and safely.

Digestion experiments with sheep, C. S. PHELPS (*Connecticut Storrs Sta. Rpt. 1898, pp. 204–220*).—Continuing the work of previous years, a number of digestion experiments with sheep are reported.

The usual methods were followed. A summary of the experiments is given in the table below:

Coefficients of digestibility—experiments with sheep.

	Organic matter.	Protein.	Fat.	Nitrogen-free extract.	Fiber.	Ash.	Available energy.
	Per cent	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent*	*Per cent.*	*Per cent.*
Sweet corn fodder (green), average of two sheep	69.4	60.3	70.3	73.7	62.9	58.3	65.7
Oat and pea fodder (green), average of two sheep	58.3	69.2	56.0	62.2	48.6	37.3	54.1
Soy bean fodder (green), average of four sheep	66.8	[illegible].2	36.0	78.6	44.3	....	60.4
Sweet corn fodder (green), average of two sheep	76.0	[illegible]3.2	69.2	81.8	38.9	31.6	71.9
Barley and pea fodder (green); average of two sheep	71.2	74.5	58.5	75.5	61.2	53.7	65.2
Barley fodder (green), average of two sheep	68.2	68.7	49.1	74.0	55.9	41.8	62.2
Fine rowen hay, average of four sheep	64.6	72.5	45.2	62.3	65.7	45.9	58.3
Fine rowen hay and Cleveland flax meal, average of three sheep	67.9	78.8	53.4	60.4	69.6	37.0	59.0
Fine rowen hay and Quaker oat feed, average of three sheep	61.3	68.5	56.3	62.8	55.6	34.7	58.4

The results of these and earlier digestion experiments at the station are summarized.

On the digestion of milk, R. W. RAUDNITZ (*Arch. Anat. u. Physiol., Physiol. Abt., 1899, No. 1–2, pp. 53–59*).—Cats were fed sterilized whole milk; milk and water; fat milk, *i. e.*, a mixture of cream, skim milk, and water; milk and water containing sodium carbonate, pancreatin, and a mixture of the two; and milk and water containing hydrochloric acid. Two or three hours after the food was given the cats were killed and the stomach contents analyzed. Among the conclusions drawn were the following: Milk diluted with water leaves the stomach more quickly than whole milk. Of two samples of milk containing the same amount of fat but different percentages of nitrogen, that containing the least nitrogen leaves the stomach sooner. The values obtained show, according to the author, that resorption in the small intestine does not keep pace with the passage of food from the stomach. Neither sodium carbonate, pancreatin, or hydrochloric acid or a mixture of sodium carbonate and pancreatin hastened the passage of milk from the stomach.

Live stock at the Central Experimental Farm, W. SAUNDERS (*Canada Expt. Farms Rpts. 1898, pp. 73–88*).—Statistics are given of the horses, cattle, swine, poultry, and bees kept at the Central Experimental Farm, and feeding experiments with steers and swine are reported.

Experiments in the feeding of steers, 1897–98 (pp. 74–86).—Tests with 11 lots of 2 steers each were made with a view to learning "how beef can be produced at the smallest cost, how such products as the farmer can easily grow can be used to the best advantage, and what results are had where rations are fed the nutritive ratio of which is wider than is usually recommended."

In all cases except lot 9 the test covered 16 weeks and was divided into 4 periods of 4 weeks each. Lots 1, 2, 5, 6, 7, 8, and 11 were fed a coarse fodder consisting of silage, turnips, cut hay, and cut straw. Lots 3 and 4 were fed silage hay, and straw; lot 9, timothy hay and turnips; lot 10, brome-grass hay and turnips. In addition the animals were fed bran, cotton-seed meal, oil meal, and mixed meal, consisting of equal parts of peas, barley, and oats. The steers were given all the coarse fodder they would eat up clean, were watered twice daily, and supplied with salt. The amount of grain fed differed in the different experiments but in general was increased as the test progressed. Lots 1 to 4, inclusive, were not given meal until the second period. The nutritive ratio of the rations varied but was in no case lower than 1:7.7 in the first period and 1:5.2 in the last period. The results of the test are summarized in the following table:

Results of feeding steers.

	Average weight at beginning	Total gain per steer	Cost of food per pound of gain		Average weight at beginning	Total gain per steer.	Cost of food per pound of gain.
	Pounds	*Pounds*	*Cents*		*Pounds*	*Pounds*	*Cents.*
Lot 1	850	155 5	4 22	Lot 7	952 5	216 5	6.53
Lot 2	977 5	188	4.61	Lot 8	877 5	199 5	5 74
Lot 3	965	140 5	6 59	Lot 9	940	188	6 75
Lot 4	867 5	163 5	4 81	Lot 10	882 5	122 5	7.81
Lot 5	852 5	169 5	6 58	Lot 11	695	198 5	4 96
Lot 6	972 5	218	5 75				

The best results were obtained, in the author's opinion, with lots 1, 2, 4, and 11. The experiments are not discussed in detail.

Experiments in fattening swine (pp. 86–88).—The value of feeding whole and ground grain, dry and soaked, as well as the value of a mixture of soaked ground grain and clover, was tested with 5 lots of 4 crossbred swine each. Lot 1 was fed a mixture of unground oats, barley and peas and bran, 2:2:2:1. Lot 2 was fed the same mixture soaked in cold water for 30 hours. Lot 3 was fed the same mixture ground and dry; lot 4, ground and soaked in cold water; and lot 5, the same grain ration with sufficient cut clover to make a mixture of 3 parts of meal to 1 of clover by weight. The mixed meal and clover were soaked in cold water on an average for 30 hours. The test began July 20, 1898, and covered 14 weeks. The pigs were fed all they would eat up clean. The following table summarizes the results:

Results of feeding swine.

	Total weight at beginning	Total gain per lot.	Food consumed per pound of gain.		Total weight at beginning.	Total gain per lot.	Food consumed per pound of gain.
	Pounds.	*Pounds.*	*Pounds.*		*Pounds*	*Pounds*	*Pounds.*
Lot 1	270	432	4 08	Lot 4	266	496	3.76
Lot 2	263	422	3 88	Lot 5	273	274	*a* 4.80
Lot 3	275	505	3.56				

a This includes 3 6 lbs meal and 1 2 lbs. clover.

No conclusions are drawn from the tests.

Experiments in feeding steers, S. A. BEDFORD (*Canada Expt. Farms Rpts. 1898, pp. 300, 301*).—The value of marsh hay as compared with mixed straw was tested with 2 lots of 4 steers each. Lot 1 was fed a ration consisting of 20 lbs. of cut native marsh-grass hay, 30 lbs. Swedish turnips, and 3 to 7 lbs. of chopped barley, while lot 2 was fed 20 lbs. of mixed cut straw, the same amount of Swedish turnips as lot 1, and 5 to 9 lbs. of chopped barley. The steers were fed for 112 days. They were purchased for 3 cents per pound and sold at the conclusion of the test for 4 cents per pound, live weight. The financial statement is based on hay at $5 per ton, turnips at 5 cents per bushel, and chopped barley at half a cent a pound. No value was assigned to the straw.

Lot 1 made an average daily gain of 1 lb. 6 oz., and lot 2, 1 lb. 4 oz. The average profit per steer for lot 1 was $7.54; of lot 2, $10.91. "It would appear that hay is not essential to the successful fattening of steers, and that wheat farmers can utilize to good advantage a portion of their straw for that purpose."

Experiments in the feeding of steers, A. MACKAY (*Canada Expt. Farms Rpts. 1898, pp. 369, 370*).—A feeding test with steers at the Indian Head Experimental Farm is briefly reported. Twelve 3-year-old steers were divided into 4 lots of 3 each and fed from November 13, 1897, to March 5, 1898. Lot 1 was given brome-grass hay and silage; lot 2, wheat chaff and silage; lot 3, threshed brome grass, silage, and bran; and lot 4, native hay, silage, and bran. In addition all the steers were fed 2 lbs. of meal (barley and wheat 2:1) per head daily during the second month, 4 lbs. during the third, and 6 lbs. during the last month of the test. "The rations were in the proportion of 2 lbs. silage to each pound of dry feed." The financial statement is based on silage at $2, brome-grass hay at $5, threshed brome grass hay at $4, native hay at $2, bran at $14, and wheat chaff at $2 per ton, and meal at $\frac{5}{8}$ ct. per pound.

The total gains made by the several lots were as follows: Lot 1, 430 lbs.; lot 2, 315; lot 3, 355; lot 4, 460. The profits on the respective lots were $27.39, $29.04, $34.09, and $44.65.

Report on experiments on the winter fattening of cattle, 1898–99, J. W. PATERSON (*West of Scotland Agr. Col. Bul. 1, pp. 22*).—To determine the comparative value of a number of concentrated feeding stuffs, a test beginning December 24, 1898, and covering 100 days, was made at the Home Farm of H. Ogilvy at Biel, with crossbred steers selected from a herd of 80. During a preliminary period of one month, the steers were divided into 2 uniform lots, and at its conclusion were subdivided into 4 uniform lots of 10 each. Lots 1, 2, and 3 were fed a basal ration of 560 lbs. of Swedish turnips with oat hay and straw *ad libitum*. In addition, lot 1 was fed 60 lbs. of decorticated cotton-seed cake and maize meal (1:1); lot 2, 60 lbs. of linseed cake; lot 3, 60 lbs. of decorticated cotton-seed cake and bruised oats (1:1), Lot 4 was fed a basal ration of 840 lbs. of Swedish turnips with oat hay and straw *ad libitum*, and 30 lbs. of decorticated cotton-seed cake in addition. During the last 17 days of the test, the amount of grain fed to lots 1, 2, and 3 was increased to 80 lbs. At the same time the Swedish turnips fed to lot 4 were increased to 933 lbs. and the grain ration to 40 lbs.

The weights of the 4 lots at the beginning of the test were 8,059, 7.824, 7,908, and 8,115 lbs., respectively. The corresponding daily gains per head were 2.23, 2.35, 2.25, and 1.99 lbs., respectively. The feeding stuffs were rated as follows: Linseed cake, $39.60 per ton; decorticated cotton-seed cake, $29.66; maize meal, $25.25; Swedish turnips, $2.40; straw, $7.25; hay, $14.55; and oats, 54 cts. per bushel. Rating the steers at $6.72 per cwt. at the beginning of the test and $8.16 per cwt. at the close of the test, and assuming the attendance was worth 12 cts. per head per week, the profit on the 4 lots was $69.25, $40.15, $60.96, and $57.18, respectively.

In the author's opinion, the gains made by all the lots were very satisfactory, slightly the best being made by lot 2. The increase during the last 17 days of the test was said to be satisfactory for all the lots, and in the author's opinion the feeding might have been advantageously continued for some time.

> "Linseed cake produced rather more increase than decorticated cotton-seed cake plus oats, but this increase did not repay the extra expense. Indeed, there was a relative loss of $20.84 from preferring linseed cake. When contrasted with the cotton-seed cake plus maize lot, the employment of pure linseed cake was still more unprofitable. Decorticated cotton-seed cake plus maize yielded exactly $29 10 more profit than linseed cake—the extra gain being all a saving in expenditure. These results merit the attention of feeders. . . . In a season of root scarcity, the advisability of limiting the turnips, as in lot 1, and giving maize instead will be specially apparent. Again, looking to lots 3 and 4, when turnips are worth $2.40 per ton to sell it will pay better to restrict them as in lot 3 and give some oats instead when oats are selling below 59 cts. per bushel of 40 lbs., or $4.72 per quarter. As the same amount of Swedish turnips and practically the same quantity of hay and straw was consumed by the first 3 lots, the relative results arrived at above for the concentrated foods are obviously in no way influenced by the fixed prices which were placed upon those foods."

Feeding experiments on the winter fattening of lambs, C. E. LYMAN, reported by C. S. PHELPS (*Connecticut Storrs Sta. Rpt. 1898, pp. 221–228*).—In these experiments, which are made with the cooperation of C. E. Lyman of Middlefield, who feeds each winter about 4,000 lambs for market, the fattening value of wide and narrow rations was compared, 2 lots of 10 lambs each (mostly selected grade Shropshires) being used for the purpose. The test, which began December 21, covered 2 periods of 31 days each. Lot 1 was fed at first a ration consisting of ⅔ pea meal and ⅓ corn, with about 1 part of clover rowen to 2 parts of corn silage. After about 10 days bran was substituted for part of the pea meal, since it was evident satisfactory gains could not be made otherwise. Until the close of the test the grain ration consisted of pea meal, bran, and corn, 2 : 1 : 1, giving a nutritive ratio of 1 : 7.2. The grain ration of lot 2 consisted of corn and pea meal, 3 : 1. The coarse fodder in the first period consisted of corn silage and clover rowen 2 : 1. During the second period the clover rowen was increased ½. The nutritive ratio of the ration was 1 : 6.8. The lambs in lot 1 weighed 882, those in lot 2, 869 lbs. at the beginning of the test; the total gains during the test were 242 and 281 lbs., respectively. The cost of a pound of gain in lot 1 was 4.93 and in lot 2, 4.77 cts.

> "It will be seen that the gains for the second lot, which were fed the wide rations, are considerably larger than for the first lot, which had the narrow ration. The wide ration (lot 2) was somewhat more expensive than the narrow ration (lot 1), but the average cost of 100 lbs. of increase was 16 cts. less for the lambs fed the wide ration."

A test was also made with 200 lambs, which were fed well-balanced rations found by experience to be profitable. The test proper began December 1, 1897, and covered 3 periods of 15, 16, and 17 days. In the first period the ration consisted of 167 lbs. each of corn and pea meal, 148 lbs. of clover rowen, and 325 lbs. of silage. In the second period the clover rowen and silage remained about the same, while the corn meal was increased to 181, the pea meal diminished to 138, and 9 lbs. of bran was added to the ration. In the third period, the 196 lambs were fed 132 lbs. of corn, 100 lbs of bran, the same quantity of pea meal daily with about the same amount of clover rowen and silage as before. The nutritive ratio in the 3 periods was 1:5.8, 1:6.1, and 1:5.6, respectively. The lambs were purchased in Chicago. A few days after their arrival in Connecticut they were sheared and yielded 3⅜ lbs. of medium wool per lamb, on an average. Near the end of the test it was necessary to slaughter 4 lambs and this fact is taken into account in tabulating the results for the third period.

At the beginning of the test the lambs weighed on an average 73½ lbs. each. During period 1 the total gain of the lot was 1,140 lbs., and the cost of a pound of gain 4.58 cts.; during the second period the total gain was 690 lbs., and the cost of a pound of gain 7.91 cts.; while during the third period the total gain was 1,230 lbs. and the cost of a pound of gain 4.85 cts. The cost is based upon hay at $10, silage at $3. bran at $15, and pea meal at $13 per ton, and corn at 38½ cts. per bushel.

> "The ration which in the long run has given us the most satisfactory results in feeding lambs is one very similar to that used in the third period with the large lot of lambs. A grain ration consisting of one-third corn, one-third bran, and one-third pea meal by weight, together with coarse fodder consisting of clover hay or clover rowen one part, and corn silage two parts, has, on the whole given us very satisfactory returns."

Pig feeding in South Dakota, E. A. BURNETT (*South Dakota Sta. Bul. 63, pp. 85-98*).—Two tests are reported which had for their object a comparison of some of the common feeding stuffs, and the collection of data regarding the cost of pork production from common grains under favorable conditions.

The first test was made with 30 pure-bred Duroc Jersey, Chester White, and Poland China pigs, divided into 6 lots of 5 each. The pigs were from 130 to 160 days old, and averaged about 114 lbs. each. During the summer they had been pastured on a variety of crops, and were given some ground barley shorts and separator skim milk. The test began October 21 and covered 4 periods of 2 weeks each. Lot 1 was fed corn meal; lot 2, wheat shorts; lot 3, corn meal and shorts (1:1); lot 4, barley meal with wheat shorts (1:1); lot 5, corn meal and ground barley; and lot 6, ground barley. Each lot received a little soft coal and salt, with a little copperas and sulphur occasionally.

The average weights of the 5 lots at the beginning of the test were 801, 775, 723, 746, 711, and 726 lbs., respectively. The average daily gains of lots 1, 2, and 6 were 1.53 lbs., 4.53, and 4.38, and 4.58 lbs. of food was required per pound of grain respectively. The average daily gains of lots 3, 4, and 5 were 1.8, 1.64, and 1.44 lbs., respectively. The corresponding amounts of food required per pound of gain were 3.9, 4.29, and 4.86 lbs.

The second test was made in 1898 with 7 lots of 4 pigs each, and was practically a duplicate of the previous test. The lots were numbered from 7 to 13 consecutively. Lots 13, 11, 10, and 12 were fed, respectively, the same ration as lots 2, 3, 5, and 6, while lots 7, 8, and 9 were fed the same ration as lot 4 in the previous test. After a preliminary period, during which the pigs were pastured on barley and oats or rape and sorghum, the test proper began September 26 and covered 4 periods of 14 days each. The following table summarizes the results:

Results of feeding pigs—second experiment.

	Weight of lot at beginning of test	Average daily gain	Food consumed per lb of gain		Average daily gain	Weight of lot at beginning of test	Food consumed per lb of gain
	Pounds	*Pounds*	*Pounds*		*Pounds*	*Pounds*	*Pounds*
Lot 7	612	1 56	4 77	Lot 11	589	1 50	4 48
Lot 8	692	1 76	4 82	Lot 12	592	1 67	4 56
Lot 9	514	1 58	4 40	Lot 13	591	1 31	5 17
Lot 10	614	1 65	4 51				

In discussing the profits of the 2 experiments, the different grains are figured at $8 per ton. Lots 1–6 were valued at $3.10 at the beginning and end of the test, a shrinkage of 4 per cent being made on the weight of the pigs at the close of the test, which was the average shrinkage on the lot when purchased. Lots 7–13 inclusive were purchased at $3 per hundred and sold at the same price without shrinkage. The cost per pound of gain in the different lots was as follows: Lot 1, 1.81 cts.; lots 2 and 13, 1.88 cts.; lots 3 and 11, 1.6 cts.; lots 4, 7, 8, and 9, 1.82 cts.; lots 5 and 10, 1.9 cts.; lots 6 and 12, 1.83 cts. The author calculates that corn meal returned in the form of pork, $13.60 per ton;

wheat shorts, $13.20 per ton; corn meal and wheat shorts (1:1), $15.46 per ton; barley and shorts (1:1), $13.70; barley and corn (1:1), $12.04; and barley, $13.60.

The experiments are discussed in considerable detail. The principal conclusions follow: "All foods and rations used in the experiment produced gains at a cost considerably below the market price of hogs at the time they were fed. All lots made the cheapest gains before reaching 150 lbs. weight, but continued to make profitable gains up to or slightly past 200 lbs. weight. The largest consumers of food according to weight made the cheapest gains. Corn and shorts made the cheapest gains, and all the rations containing corn gave better average results than all the rations containing no corn."

Feeding experiments with blood molasses feed for horses, H. GOLDSCHMIDT (*Landmandsblade, 32 (1899), No. 25, pp. 349–353*).—Twenty three horses belonging to the Copenhagen Milk Supply Company were included in the experiment. They were divided into 2 lots. Lot 1, made up of 7 horses, was fed the regular ration of barley and oats, 1:2, during the first part of the test; later, oats and hay. Lot 2, made up of 16 horses, received the same feed with the following changes during the 3 periods into which the experiment was divided: In period 1, 2 lbs. of molasses feed was substituted for 2 lbs. of grain; in period 2, 2½ lbs. of molasses feed was substituted for 3 lbs. of grain; and in period 3, 3 lbs. of molasses feed took the place of 4 lbs. of grain. The amount of grain fed during the different periods ranged from 10½ lbs. to 12 lbs. and from 12 to 13 lbs. of hay was fed per head per day. The results obtained show that 3 lbs. of molasses feed had about the same feeding value as 4 lbs. of grain. At the prevailing prices, the molasses feed was cheaper than grain; by replacing ¼ of the grain with this feed, an annual saving of $5.36 per horse would be effected, while in the case of high prices for oats, the saving would reach $13.40 per horse annually.—F. W. WOLL.

Report of the poultry manager, A. G. GILBERT (*Canada Expt. Farms Rpts. 1898, pp. 221–240, pl. 1, figs. 5*).—Statistics are given of the poultry kept at the station during the past year, methods of feeding them, comparative egg yield for 2 years, eggs set, chickens and ducks hatched, gain in weight of chickens, etc.

Experimental fattening of chickens without forced methods, (pp. 234–240).—The relative merits for fattening without forced methods of scrubs, first cross, and thoroughbred chickens were tested with 10 lots of 4 chickens each made up as follows: Lots 1 and 2, barnyard chickens; lot 3, first cross light Brahma-Buff Cochins; lot 4, light Brahmas; lot 5, Silver Laced Wyandottes; lot 6, White Indian Game and White Java cross; lot 7, Barred Plymouth Rocks; lot 8, White Plymouth Rocks; and lot 9, White Wyandottes. The lots were fed 3 times a day all they could eat of oatmeal, barley, and corn meal, 2:1:1, mixed with sweet milk. About 2 weeks after the beginning of the test beef suet (1 ounce to each 4 fowls) was also fed each meal. The chickens were given grit and an abundance of water. Two of the chickens were pullets; the remainder, cockerels. The test began October 31 and covered 8 weeks. During this period 1 chicken in lot 4 died and 1 each in lots 5 and 9 was not in good condition for a portion of the time. The foods consumed and gains made per week by the different chickens and lots are recorded in detail. At the close of the test the chickens were fasted for 36 hours previous to killing. They were killed by dislocating the neck, and carefully plucked dry and packed for shipment. The weight after fasting 36 hours in lots 4 to 9, and in all cases the weights after plucking, are recorded. The weight of the entrails, of the waste, heads, feet, etc., weight after dressing, weight of the giblets, fat, flesh, bones, and extractives obtained on boiling are recorded for 1 chicken in each lot. The results of the test are summarized in the following table:

Results of feeding experiments with chickens.

	Average weight per chicken.										Weight of entrails, head, feet, etc *a*	Weight of parts. *a*				
	At beginning of test.		At end of test.		After 36 hours' fast.		After plucking.		After dressing *a*			Giblets.	Fat.	Flesh.	Bone.	Extractives obtained by boiling.
	Lbs.	*Ozs*	*Lbs.*	*Ozs*	*Lbs.*	*Ozs.*	*Lbs.*	*Ozs*	*Lbs*	*Ozs.*	*Ozs*	*Ozs*	*Ozs*	*Ozs*	*Ozs.*	*Ozs.*
Lot 1...	4	12½	6	2	....		5	9½	4	1	20½	4	8½	44	10½	4
Lot 2 ..	3	9	5	2	....		4	9½	3	1½	18	4	2	39	8	3
Lot 3...	6	5	8	4½	....		7	10½	5	7	28½	5	5	54½	13	5
Lot 4...	6	2½	6	3	6	1	5	9½	4	8½	28	5½	5	50	11	4½
Lot 5 ..	5	0	6	5	5	14½	5	12	3	7½	18	4	4	39	10	4
Lot 6...	4	2½	5	12½	5	10½	5	6	3	12½	17½	4	7	32	7½	3
Lot 7 ..	5	15	7	8½	7	6½	6	15	4	8	25	4½	2	46	11½	6
Lot 8...	5	11	7	6½	7	4	6	12½	4	11	26	5½	3½	49	10½	5
Lot 9 ..	4	6	6	1½	5	11	5	4	4	2	21	5	4½	44	12	4

a These values were determined with a representative chicken from each lot.

Poultry, S. A. BEDFORD (*Canada Expt. Farms Rpts. 1898, pp. 302, 303*).—The value of pullets compared with old hens as layers was tested with 2 lots of 11 chickens each. Lot 1 was made up of 7 Black Minorca and 4 White Plymouth Rock hens 2½ to 4 years old, and lot 2 of the same number of pullets of these 2 breeds, 6 months old. All the chickens were fed in the morning a ration of equal parts of crushed mixed grains and 1 oz. of cut bone per fowl. The food was moistened. In the evening they were fed whole wheat, oats, and barley 2:1:1. From January 4 to March 4 the pullets laid 144 eggs and the hens 105.

The value of bone as an egg producer was tested with 2 lots each consisting of 3 Plymouth Rock and 3 Black Minorca pullets 6 months old. Both lots were fed on bran and crushed mixed grain 1:1, wet, in the morning, and wheat screenings, oats, and barley 2:1:1 in the evening. In addition, lot 1 was fed an ounce of green bone per chicken daily in the morning. In the 3 months beginning January 4 lot 1 laid 83 and lot 2, 52 eggs.

The cost of a pound of gain when chickens are fattened in pens was tested with 4 Plymouth Rocks. In one month beginning October 25 they consumed 7½ lbs. of wheat, 3¾ lbs. of oats, and the same amount of barley. The grain was crushed and fed moist in the morning and whole in the evening. The chickens weighed 16 lbs. 14 oz. at the beginning of the test and gained 5 lbs. The cost of a pound of gain was 3 cts.

Concerning "slimy" bread, R. SENDTNER (*Chem. Ztg.*, *23* (*1899*), *No. 79, p. 827*).

Canadian and Hungarian flours, F. T. SHUTT (*Canada Expt. Farms Rpts. 1898, pp. 153, 154*).—An analysis is reported of "Best Patent" and of Hungarian flour.

Composition of meat conserves, PELLERIN (*Jour. Pharm. et Chim., 6. ser., 9* (*1899*), *No. 10, pp. 20–25; abs. in Ztschr. Untersuch. Nahr. u. Genussmtl., 3* (*1900*), *No. 1, p. 32*).—The author reports the examination and analysis of bouillon from canned meat.

The digestibility of sterilized milk, JEMMA (*Clin. Med. Italiana; abs. in Diet. and Hyg. Gaz., 16* (*1900*), *No. 2, p. 83*).—The author reports, as the result of experiments in artificial digestion, that the digestibility of milk is not impaired by sterilizing, and that sterilized milk diluted with a solution of milk sugar is more easily digested than pure sterilized milk.

Contribution to the study of the composition of hens' eggs, A. JUCKENACK (*Ztschr. Untersuch. Nahr. u. Genussmtl., 2* (*1899*), *No. 12, pp. 905–913*).—The author studied especially cholesterin and other phosphorus compounds in egg yolk.

Preserving eggs (*Queensland Agr. Jour., 4* (*1899*), *No. 3, pp. 418, 419*).—Several methods of preserving eggs are quoted—as preserving in a water glass solution, preserving with a solution of salt and borax poured over eggs covered with vegetable ashes, and packing in some material (bran, salt, etc.) in tight boxes.

Apple jelly, LOOK (*Ztschr. Offentl. Chem., 5* (*1899*), *pp 359–366; abs. in Ztschr. Untersuch. Nahr. u. Genussmtl., 2* (*1899*), *No. 12, pp. 934, 935*).—Analyses of a number of sorts of commercial jelly are reported.

The composition of raisins, A. BORNTRAGER (*Ztschr. Untersuch. Nahr. u. Genussmtl., 2* (*1899*), *No. 3, pp. 257–260*).—The composition of a number of samples is reported.

Recent progress in regard to wines and food stuffs, E. LIST (*Chem. Ztg., 23* (*1899*), *No. 74, pp. 757–759; No. 76, pp. 784–788*).—A review.

Muscle, brain, and diet: A plea for simpler foods, E. H. MILES (*London: Swan, Sonnenschein & Co.; New York: The Macmillan Co., 1900, pp. XV+345*).—The author believes a diet of what he terms simpler foods, *i. e.*, a "vegetarian diet," is desirable. His own experience and considerable other data are recorded, which he believes supports his contentions. The book is prepared from a popular rather than a scientific standpoint.

The army ration, C. SMART (*Sanitarian, 44* (*1900*), *No. 363, pp. 125–129*).—In this article, quoted from the Boston Medical and Surgical Journal, December 9, 1899, the author describes the army ration and discusses its value for soldiers in the tropics. Attention is drawn to the fact that the ration is capable of considerable variation to suit special circumstances.

The army ration in the tropics, P. R. EAGAN (*Sanitarian, 44* (*1900*), *No. 363, pp. 129, 130*).—A brief note supplementing the above article.

Analyses of fodders and feeding stuffs, W. O. ATWATER and F. G. BENEDICT (*Connecticut Storrs Sta. Rpt. 1898, pp. 229–242*).—The composition of a number of materials is reported. These include green fodders—*Bromus inermis*, meadow fescue, orchard grass, redtop, timothy, cowpea fodder, barley and pea fodder, barley fodder, oat and pea fodder, soy bean fodder, sweet corn fodder, and corn for silage; cured fodders and hay—corn stover, clover rowen, mixed hay of clover and grass, Hungarian hay, hay of mixed grasses, fine rowen hay, and second quality hay. In addition, several samples of corn silage were analyzed. The milling and by-products include Chicago gluten meal, Cleveland flax meal, cotton-seed meal, Quaker oat feed, wheat bran, soy beans, and four o'clock seed. [According to a correspondent in Florida four o'clock seed is a very satisfactory feed for poultry.]

Analyses of foods, feeding stuffs, etc., H. SNYDER (*Minnesota Sta. Bul. 63, pp. 495–503, 505–508*).—Analyses are reported of linseed oil meal, foreign and domestic flaxseed (oil content), oat bran, oat feed, wheat screenings, speltz wheat, corncobs, wild rice, corn (yellow and white), cattle-feed mixtures, rape plant at different stages of growth, corn fodder, oat hay, pea hay, dwarf German kale, sand vetch, sorghum, peas and oats, *Bromus inermis*, sugar, sorghum, sirup, butter, dairy salt, skim milk, and 2 food preservatives.

The feeding value of the residue from wine making (*Bul. Soc. Cent Agr. Hort. et Acclim.* [*Nice*], *39* (*1899*), *No. 8, pp. 145–149*).

The use of cane leaves in feeding cattle, BONÂME (*Sucr. Indig., 54* (*1899*), *No. 18, pp. 550–553*).

Artificial milk or Liebig milk for calves and young pigs, F. RIGAUX (*Belg. Hort. et Agr., 11* (*1899*), *No. 17, p. 265*).—A note on the use of a mixture of flour, malt, carbonate of potash, and a little chalk in skim milk for calves and young pigs.

The formation of fat from protein according to the latest opinion of the C. Voit school, E. PFLÜGER (*Arch. Physiol.* [*Pflüger*], *77* (*1899*), *No. 11–12, pp. 521–554*) —A controversial article.

Concerning the absorption of fat, W. CONNSTEIN (*Arch. Anat. u. Physiol., Physiol. Abt., 1899, No. 1–2, pp. 30–32*).—Experiments were made with dogs fed lanolin in addition to a ration of dog biscuit. This fat melts at 40 to 42° C. and is easily emulsified. It saponifies with great difficulty in the intestine and is practically unabsorbed. Therefore, in the author's opinion, the conclusion is warranted that the digestibility of any fat depends upon its cleavage, and that its capacity for emulsification is only a secondary matter.

Report of the poultry division, D. D. HYDE (*New Zealand Dept. Agr. Rpt. 1899, pp. 153–161, figs. 11*).—The different breeds of chickens and ducks are described and the work of the poultry department briefly reported.

A handbook for farmers and dairymen, F. W. WOLL (*New York: John Wiley & Sons, 1900, pp. 437*).—A second edition of this book containing a large amount of information in condensed form over a wide range of subjects. The edition is said to be thoroughly revised.

DAIRY FARMING—DAIRYING.

Dairy experiments, C. B. LANE (*New Jersey Stas. Bul. 137, pp. 24*).—The record of a grade dairy herd for 3 years is summarized and discussed, and experiments comparing balanced and unbalanced rations and different quantities of feed are reported.

The yield, composition, and cost of milk (pp. 3–12).—The grade dairy herd used in a study of this question averaged annually 22, 25, and 30 cows for the years ended April 1, 1897, 1898, and 1899. The records for 1897 and 1898 were given at some length in the annual reports of the stations for those years (E. S. R., 10, p. 483; 11, p. 785). Frequent changes were made in the herd by replacing older and unprofitable animals by new ones. Four cows remained in the herd for the 3 years and 10 others remained for 2 years. Of 25 cows for which a record of one year or more was obtained the annual milk production of the best, poorest, and average cow was, respectively, 10,317, 4,530, and 6,585 lbs., with a corresponding butter production of 486, 226, and 327 lbs. The fat content of the milk of the individual cows for 1 year ranged from 2.8 to 6.4 per cent, with an average of 4.25 per cent.

During the summer the ration fed consisted of 60 lbs. of green forage, 4 lbs. each of wheat bran and dried brewers' grains, and 2 lbs. of corn meal, and during the winter of 30 lbs. of silage, 5 lbs. of hay, 4 lbs. each of bran and brewers' grains, and 2 lbs. of linseed meal. The average cost of the ration was 11.5 cts., 5 cts. being charged to purchased feeding stuffs and 6.5 cts. to farm crops. The cost of food for 1 year was $1,049.38. Labor and interest on the value of the herd increased the total cost of milk production to $1,651.88. The total yield of milk was 75,511 qt., the cost per quart being, therefore, 1.39 cts. for food, or 2.19 cts. for food, labor, and interest. At 3 cts. per quart for milk the net profit from the 25 cows, not including the value of 265 tons of manure, was $613.45. The increased cost of producing milk according to sanitary requirements is discussed in connection with these results.

A study was made of the question of maintaining a standard of quality in herd milk throughout the year. A table shows the average composition of herd milk and the variation in composition of the milk of individual cows for each month during the 3 years. "Milk containing 4 per cent of fat could have been practically guaranteed throughout the first year, 4.25 per cent the second, and 4.50 per cent the third."

Experiments with different rations (pp. 12–24).—A ration made up of 30 lbs. of silage, 5 lbs. of timothy hay, 4 lbs. of wheat bran, 4 lbs. of dried brewers' grains, and 2 lbs. of linseed meal was compared with one composed of 12 lbs. of cornstalks, 8 lbs. of timothy hay, and 4 lbs. of corn meal. The nutritive ratio of ration 1 was 1:5.3 and of ration 2, 1:13.5. The rations were fed to 2 lots of 2 cows each for 30 days, when they were reversed, and after a transition period of 7 days were fed for another period of 30 days. A table gives the daily record of each cow. The total production on the first ration was 2,701.7 lbs. of milk and 131 lbs. of butter, and on the second ration 2,014.2 lbs. of milk and 94.3 lbs. of butter, making an actual gain in production of over one-third in favor of the balanced ration. The cost of food for the production of 100 lbs. of milk and 1 lb. of butter was practically the same in each case. It is therefore argued that 20 cows fed the balanced ration would produce as much milk at the same cost for food as 30 cows fed the other ration, the profits being much greater with the smaller number of cows on account of less labor and a smaller investment being required.

A summary is given of tests of 3 grade cows for 1 week and comment is made on the value of records for short periods.

Several tests, lasting 1 week each, were made with 2 cows to determine the profits from feeding different quantities of mixed grains. Rations consisting of 10, 15, 20, and 24 lbs. of the same proportional mixture of wheat bran, dried brewers' grains, and linseed meal were fed with silage and hay. The results are given in tables and discussed. "Rations containing feeds in excess of 10 lbs. per day, while they were profitable, were less profitable than those containing this amount."

Experiment with milch cows, R. ROBERTSON (*Canada Expt. Farms Rpts. 1898, pp. 258–261*).—A study was made of the profits from a herd of 29 cows for one year ended November 27, 1898. The cows were charged with all the feed consumed and given credit for their products at current prices. A table shows the breed, number of days milked, yield of milk and butter, receipts from butter and skim milk, cost of feed, and other data for each cow. Excluding one cow which had been milked 210 days before entering the test, and 3 cows which were removed from the test at the end of 6 months, the profits per cow ranged from $4.10 to $28.64, and averaged $16.25. The results are averaged separately for the summer and winter periods of 6 months each. Cows fresh in the fall were more profitable than cows fresh in the spring.

Test of malt-sprouts-molasses for milch cows, E. RAMM (*Milch Ztg., 28 (1899), No. 41, pp. 611, 642*).—In a series of feeding experiments with milch cows conducted by the author a comparative test was made of malt-sprouts molasses and peanut cake. From April 4 to April 7, 8 cows were fed peanut cake in addition to hay, straw, roots, and dried brewers' grains. During a second period of 4 days beginning April 13, the cows were fed the same ration except that the peanut cake was replaced by the same quantity of malt-sprouts-molasses. From April 26 to April 29 the cows were fed again on the peanut-cake ration. The data are given in full in tabular form. A summary of the results for 5 cows shows that the yield of milk was slightly higher on the peanut ration, but the fat content was lower, so that the average daily yields of fat and total solids were practically the same on the two rations. The author concludes that malt-sprouts molasses proved an efficient and wholesome concentrated feeding stuff for milch cows, and under the conditions of the experiments was equal in value to peanut meal.

Test of gluten meal for milch cows, E. RAMM (*Milch Ztg., 28 (1899), No. 12, pp. 658–660*).—A comparative test of gluten meal and peanut cake was made with 5 cows and included 3 periods of 4 days each, beginning respectively on May 5, 14, and 23. During the first and third periods the daily ration included 6 kg. of peanut cake. During the second period an equal quantity of gluten meal was fed in place of the peanut cake. The results are tabulated and summarized. The yields of milk, fat, and total solids and the specific gravity of the milk were slightly higher on the gluten-meal ration, but the percentages of fat and solids were lower. The experiment is considered as showing that gluten meal is a very efficient feeding stuff for milch cows.

Test of raw sugar for milch cows, E. RAMM (*Milch Ztg., 28 (1899), No. 43, pp. 673, 674*).—In continuation of the above experiment raw sugar was compared with peanut cake. A ration containing 6 kg. of raw sugar was fed to 5 cows for 4 days commencing June 4, and the results are compared with the average results obtained from feeding a ration containing peanut cake in place of the sugar to the same cows for two periods of 4 days each, commencing respectively May 23 and June 13. The results are tabulated and summarized. On the sugar ration the cows gained more in weight but produced less milk and butter fat than on the peanut ration.

Changes in milk caused by freezing, M. SIEGFELD (*Molk. Ztg., 13 (1899), No. 32, pp. 497–499*).—Several experiments in freezing milk and cream are reported and changes in the microscopical appearance of the fat globules and in the properties of the casein as a result of freezing are described.

Analyses were made of samples from different portions of a block of frozen milk. The upper portion of the block contained 8.45 per cent of fat and the lower portion 2.11 per cent. The percentage of total solids increased toward the center of the cake.

To eliminate the influence of the fat an experiment was made with skim milk. The outer portion of the frozen sample contained 7.03 per cent of solids and the central part 15.9 per cent. Another sample of the skim milk was kept at 5–6° C. for 8 hours. Ice crystals were formed in the outer portion. Analyses of the ice, the serum mechanically held by the ice crystals, and the central portion of the sample remaining unfrozen, gave the following percentages of solids for the 3 portions, respectively: 0.06, 9.94, and 12.81. The fresh sample contained 8.32 per cent of solids and 0.07 per cent of fat.

In 2 experiments one half of each lot of cream was frozen. In the first experiment the 2 portions were brought to 16° C. and churned at that temperature. In the second experiment the churning was done at 13°. The freezing of the cream resulted in decreasing the time required for churning 13 minutes in the first case and 15 minutes in the second. The content of fat in the buttermilk from the unfrozen cream churned at 16 and 13° was respectively 5 and 4.8 per cent, and from the cream which had previously been frozen, 2.95 and 1.55 per cent. A number of other experiments confirmed these results.

Some practical applications of bacteriology in European dairying, H. W. CONN (*Connecticut Storrs Sta. Rpt. 1898, pp. 67–99*).—This is an interesting account of the conditions found by the author as the result of an examination of various institutions in England, Holland, Denmark, Germany, and Switzerland. The subject is discussed under 3 general headings, (1) bacteriology and the milk supply in European cities, (2) bacteriology in butter making in European dairies, and (3) bacteriology in cheese making in Europe. A summary regarding the more important practical applications of bacteriology to dairying in Europe is given as follows:

"(1) A knowledge of the action of bacteria upon milk has led to a very careful guarding of milk from contamination. This has been directed first to the cow, second to the conditions in the cow stall, third to the cleaning of the milk vessels, and fourth to the methods of handling the milk.

"(2) The demonstration of the agency of milk in distributing disease has led to the taking of great pains to prevent the milk from coming in the vicinity of disease germs. This has resulted in (1) the attempt to exclude all persons who have contact with contagious diseases from any participation in handling the milk; (2) greater care in regard to the water used in the dairy; and (3) the attempt to exclude from the dairy herd all animals suffering from any sort of udder disease.

"(3) Proper regulations can be better enforced by large business firms than by public statute, and partly as a result of this the milk supply of the large cities is passing into the hands of a few large firms.

"(4) As the public has learned how disease is distributed by milk the demand for sterilized milk has grown until it can be purchased in most cities from the ordinary milkmen. The dislike of the taste of sterilized milk and the belief that sterilizing makes it somewhat less easily digested have led to the adoption of the process of pasteurizing, though it is rather slow in coming into use.

"(5) The use of bacteria cultures for cream ripening in the process of butter making is confined chiefly to Denmark and North Germany. In Denmark over 95 per cent of the butter is made by the use of artificial pure cultures of bacteria inoculated into pasteurized cream. The results have been highly satisfactory to the Danish butter makers. Oleomargarine is largely made by the use of pure cultures.

"(6) Up to the present no important practical applications of bacteriological knowledge have been made in the process of cheese making. The only instance in practice where bacteria are artificially inoculated into milk to produce cheese ripening is in the use of 'slimy whey' in the making of Holland cheeses."

Examinat'on of butter and milk for tubercle bacilli, ASCHER (*Ztschr. Hyg. u. Infectionskrank., 32 (1899), No. 3, pp. 329–344*).—Twenty-seven samples of butter from 22 stores were examined and 2 samples were found to contain tubercle bacilli. One came from a large creamery and the other from an estate. A sample of skim milk from the creamery also showed tubercle bacilli. This skim milk was being used to feed calves and pigs. The author believes the pasteurizing of skim milk and centrifugal slime at cooperative creameries before returning it to patrons should be compulsory. The milk of 7 cows which had reacted with tuberculin but showed no clinical evidence of tuberculosis was repeatedly tested for bacilli by inoculating guinea pigs, with entirely negative results.

Trials of pasteurization apparatus, 1897–1899, H. P. LUNDE and P. V. F. PETERSEN (*43. Rpt. K. Vet. Landbohöjskoles Lab. Landökon. Forsög [Copenhagen], 1899, pp. 152, ill.*).—This is an account of a critical investigation of 5 different forms of Danish pasteurization apparatus, 3 of which are modifications of the original Fjord pasteurizer. The various factors affecting the efficiency of pasteurizers were studied in detail; a new modification of the Fjord apparatus suggested by the results of the investigations was constructed and is described and illustrated in the report. Tables showing the effect on the efficiency of pasteurizers of the temperature and the heat-conductivity of the heating surface are given, and formulas for their calculation presented, as well as other factors that determine the efficiency of pasteurizers. Among the results obtained may be mentioned that a pasteurization apparatus under otherwise similar conditions will be found to possess only between one-half and one-third as large a capacity when the milk (or cream) is to be heated to 85° C. (185° F.) as when it is heated to 70° C. (158° F.).—F. W. WOLL.

How to select good dairy cows, E. RIGAUX (*Ind. Lait*, *25* (*1900*), *Nos. 2, pp. 9–11; 3, pp. 17–19; 4, pp. 25, 26*).—The principal breeds of dairy cattle are enumerated and the conformation of the dairy cow is discussed.

Modern dairying, D. WILSON and R. CROWE (*Melbourne: Dept. Agr. Victoria, 1898, pp. 66*).—This is intended for an "up-to-date manual" for dairymen in Victoria.

Malt-sprouts-molasses as a feeding stuff for milch cows (*Milch Ztg.*, *28* (*1899*), *No. 37, pp. 595–597*).—In a feeding experiment with 6 cows covering about 6 weeks, a mixture of malt sprouts and molasses was of practically the same value as roots and wheat bran. The material used consisted of malt sprouts, 47.5 per cent, and molasses, 52.5 per cent, and had been kept in storage without an indication of molding or other deterioration for 8 months previous to the experiment. Its use as a substitute for roots and bran is considered dependent solely upon the cost.

Influence of food on the composition of butter, A. RUFFIN (*Ind. Lait.*, *25* (*1900*), *No. 1, pp. 1, 2*).—Determinations of the index of refraction, saponification number, and volatile acids of samples of butter made from cows fed cotton-seed cake, peanut cake, and cocoanut cake alone and in combination with forage are considered as showing some variations in the composition of butter due to the different feeding stuffs.

Complete reports on investigations of the milk of 63 Dutch cows bred in East Prussia during one or more periods of lactation (*Gesamtberichte über die Untersuchung der Milch von dreiundsechzig Kühen des in Ostpreussen rein gezüchteten holländischen Schlages während der Dauer einer oder mehrerer Laktationen. Berlin: Paul Parey, 1899, pp. 551; abs. in Milch Ztg.*, *28* (*1899*), *No. 39, pp. 617, 618*).

Tests of dairy herds in Silesia, B. SCHULZE (*Milch Ztg.*, *28* (*1899*), *No. 35, pp. 549, 550*).—Results of tests of 12 cows for 4 months and of 48 cows for 1 year are given.

Tests of milch cows in Algau (*Milch Ztg.*, *28* (*1899*), *No. 47, pp. 740–743*).

Observations on dairying, A. J. MCCLATCHIE (*Arizona Sta. Rpt. 1899, pp. 259, 260*).—A summary account is given of tests of several dairy herds.

Composition of Holland butter, W. G. INDEMANS (*Ind. Lait.*, *24* (*1899*), *No. 39, p. 310*).—This is a brief summary of determinations during 1898 of the volatile fatty acids of 600 samples of butter with reference to seasonal variations. A table shows the maximum, minimum, and average Reichert number for the samples analyzed each month. No general deductions are drawn.

Necessity of reforms in dairying, B. PLEHN (*Milch Ztg.*, *28* (*1899*), *No. 42, pp. 660, 661*).—A discussion of the production and sale of milk in Germany according to sanitary requirements.

The adulteration of butter, MARSAC (*Ind. Lait.*, *24* (*1899*), *No. 39, pp. 309, 310*).—The author reviews experimental work by several investigators testing the sesame oil reaction for the detection of margarin in butter.

Adulteration of milk and butter in Germany (*Ind. Lait.*, *24* (*1899*), *No. 45, p. 358*).—This is a brief review of a report on this subject from the Institute of Hygiene at Hamburg. Variations in the composition of milk and butter are discussed in connection with legal standards. A case is noted where the removal of cows from a clover pasture in October followed by feeding a mixture of peanut cake, wheat bran, and ground oats and barley resulted in the production of butter having an abnormally low content of volatile fatty acids. The sesame oil reaction for the detection of margarin in butter is not considered wholly conclusive.

Cynarase, a new diastase which coagulates milk, G. E. RASETTI (*Abs. in Ann. Agron.*, *25* (*1899*), *No. 12, p. 620*).—A description of a ferment prepared from the flowers of the wild artichoke (*Cynara cardunculus*), and used in Italy for making a kind of cheese from sheep's milk. It is said to be superior for this purpose to rennet, giving properties to the cheese which are much prized. The properties and preparation of the ferment are described.

"Germ-free" milk for feeding infants and for general use, F. SIEGERT (*München. Med. Wchnschr., 46 (1899), p. 1533; abs. in Chem. Ztg., 23 (1899), No. 96, Repert., p. 354*).—Forster's method, by which the less resistant pathogenic micro-organisms in milk are killed, is used in a commercial way in Strasburg. The milk is produced under as cleanly conditions as possible and placed at once in liter flasks closed with rubber stoppers and heated for 25 to 30 minutes in a water bath at 65° C. The cost of this operation is said to be about 2 pfennigs (0.5 ct.) per bottle of 900 cc. contents.

Investigations on the virulence of milk of tuberculous cows, DOUGLAS (*Abs. in Ztschr. Medizinalbeamte, 12 (1899), No. 22, p. 750; and Ztschr. Fleisch u. Milchhyg., 10 (1899), No 3, p. 53*).—In these experiments, made by an English medical officer, 8 cows out of 15 examined were found to have udder tuberculosis. With the milk of these 8 cows 48 experiments were made, 34 of which showed a transmission of tuberculosis. In 69 experiments with the milk of tuberculous cows, in none of which the udder was affected, the disease was not transmitted in a single case.

Creaming, C. H. WATERHOUSE (*Agr. Education, 2 (1899), No. 2, pp. 30, 31*).—A popular discussion of different methods.

On an improved process for renovating butter, H. SCHROTT (*Milch Ztg., 28 (1899), No. 40, pp. 630, 631*).

Bacteriology in practical cheese making in Europe, H. W. CONN (*Amer. Cheesemaker, 14 (1900), No. 167, pp. 1, 2*).

Problems in cheese making, G. A. SMITH (*Amer. Cheesemaker, 14 (1900), No. 167, pp. 4, 5*).—A popular discussion of the qualifications of cheese makers and the cheese-producing power of different milks.

VETERINARY SCIENCE AND PRACTICE.

Report of the veterinary department, W. C. LANGDON (*North Dakota Sta. Rpt. 1898, pp. 29–32*).—This report contains an account of experiments which were made for the purpose of testing the value of mallein and creolin in the treatment of glanders. Horses which were suffering from glanders were given weekly injections of 1 cc. of mallein and were given 1 dr. of creolin in ½ pt. of water 3 times daily. Beside the creolin received by way of the mouth, the horses were also given a daily rectal injection of this substance in a 1 per cent solution of water. After this treatment had been conducted for 3 weeks, the horses gave clinical symptoms of the bad effects of creolin. In order to overcome its depressing action the horses were given pulverized digitalis leaves and pulverized nux vomica with sulphate of iron. The dose of creolin was then increased to 2 dr. 3 times a day. This treatment was continued for 5 weeks, at which time all clinical symptoms of glanders had disappeared. Later the treatment was discontinued and the horses were put to work. At the close of the season one of the horses was killed and a *post-mortem* examination revealed no living germs of glanders. Two horses were inoculated with pure cultures of the glanders bacillus and then treated in the manner just outlined. Only one of these horses has been destroyed, and in this case the *post-mortem* failed to develop any evidence of glanders bacillus in the living condition.

Intravenous injection of anthrax bacillus in sheep which have been strongly immunized against anthrax and the interaction of the specific antitoxin and the bacillus, A. SCLAVO (*Centbl. Bakt. u. Par., 1. Abt., 26 (1899), No. 14-15, pp. 425-431*).—The simultaneous injection of protective serum and a culture of anthrax bacillus produced an elevation of temperature. After a second inoculation of the bacillus there was only a slight temperature reaction or none at all. Protective substances could not be demonstrated in the blood serum of these sheep until some time after the sheep were themselves able to resist the anthrax bacillus. The author's experiments indicated that repeated inoculation of the bacillus would eventually overcome the resistance of the organism. In explanation of this condition it is suggested that the protective substances do not operate directly against the bacillus, but indirectly through the medium of the leucocytes.

The present attitude of European science toward tuberculosis in cattle, H. W. CONN (*Connecticut Storrs Sta. Rpt. 1898, pp. 11-66*).—This paper contains a general discussion of the opinions of European veterinarians and agriculturists upon the various problems connected with tuberculosis in cattle.

Tuberculous cows and the use of their milk in feeding calves, C. S. PHELPS (*Connecticut Storrs Sta. Rpt. 1898, pp. 100-112*).—Four cows which responded to the tuberculin test were selected for the experiment, for the reason that tuberculosis seemed to be present in them in its earlier stages. The purpose of the experiment was to study "the effect of the milk of slightly diseased cows when fed to healthy calves, and also the relative danger from the spread of the disease by association with diseased animals." The cows were tested at intervals by the college veterinarian. Three months after beginning the experiment the cows were tested and all 4 responded to the test. Three months later they were tested again and only 2 responded. The next test occurred about 4 months later, when none of the cows gave any response to the test.

Detailed records are given of the results of feeding the calves upon the milk of these cows. The calves were also tested with tuberculin. The results of the experiments may perhaps be best stated in the author's own words:

> "Bovine tuberculosis is usually a disease of slow development, its progress depending quite largely upon the general vigor of the animal and its power to resist the action of the germs. In nearly 2½ years that the tuberculous cows have been at the station, only 1 secondary case has appeared, and this was discovered about 6 months after the feeding period with milk had ended.
>
> "In the experiments here reported, 8 calves have been fed upon the milk of tuberculous cows for periods varying from 3 months to 16 months without developing the disease.
>
> "The results of these experiments coincide with the general results of European

observations, and indicate that the danger from the spread of tuberculosis through the milk of cows to man or to other animals is not as great as has generally been supposed. In the earlier stages of the disease and at all times when the udder is not affected, the danger from the use of the milk is quite limited. Great stress, however, should be laid on the danger of using milk from cows which show any symptoms of udder affection."

Louping ill and the grass tick, E. G. WHELER (*Jour. Roy. Agr. Soc England, 3. ser., 10 (1899), pt. 4, pp. 626–644, figs. 7*).—This paper is occupied for the most part with an account of a study of the habits and life history of the grass tick (*Ixodes reduvius*). Detailed descriptions are given of the egg, larva, pupa, adult male, and adult female. The eggs probably are laid at the roots of coarse herbage. The larvæ are 6-legged. They climb upon the stems of grasses in a manner similar to that of other related ticks, and are thus brushed off upon passing animals. After fully distending themselves with blood, they fall to the ground, where they remain for a varying length of time, depending upon climatic and other conditions. During this period the molting takes place, and the ticks pass into the pupal stage. In this condition they again attach themselves to animals, and after becoming filled with blood, again drop to the ground, where a second molting occurs. The adults again attach themselves to animals, and the females, after being distended with blood, drop to the ground and deposit their eggs. The number of eggs deposited by a single female is large, varying from about 2,000 to 15,000.

According to the author's observations, the ticks fast during the periods when they are upon the ground. It is probable that no nourishment of any sort is taken during these periods. It was shown by experiments that the ticks could live for nearly a year without any nourishment, provided they were protected against desiccation. In a dry atmosphere, or exposed to the sun, they died within two or three days.

The time required for the completion of the life cycle varies exceedingly, and depends upon the temperature and a number of other natural conditions. The variation in time may be from 1 to 3 years. It is possible for the tick to complete the life cycle in slightly less than a year, provided the temperature is favorable and the tick is successful in securing a host readily. The grass tick is known to attack a considerable variety of animals, including cattle, horses, deer, sheep, and often men and dogs. Only cattle and sheep, however, are found to acquire louping ill from the attack of the tick.

Wherever coarse herbage abounds, and a moderate amount of moisture is present, the ticks are enabled to pass their resting stages successfully upon the ground. If, on the other hand, the grass is short, and the ticks are therefore exposed to the direct rays of the sun, they can not tide over these resting periods between the different stages, and if they drop upon such ground they perish. Some pastures are known to be free from louping ill, and this condition may be accounted for in the way just indicated. In order to exterminate the tick, it is not sufficient to dip the sheep and thus kill the ticks which may be at the time upon the sheep. Those ticks which at the time were upon the ground will escape and will be in position to infect sheep which are brought upon the premises. The author recommends as measures for the destruction of the ticks the burning and cutting of long grasses, rushes, etc.; the removal of diseased sheep to a separate inclosure, where handpicking of ticks and dipping may be performed; giving salt and sulphur to infected sheep; and the slaughter and burial of all infected sheep. Inoculation for the purpose of producing immunity has been tried with some success, and better results are to be hoped for in this line.

A method for the differential diagnosis of the bacillus of Eberth and the coli bacillus, L. A. Silberberg (*Russk. Arch. Patol. Klin. Med. i Bakt., 8 (1899), No. 2, pp. 152–156*).—These two bacilli may be distinguished by differences in their reaction to arsenious acid.

Successful treatment of tetanus with bromid of soda, chloral hydrate, and pilocarpin, Aryazhev (*Arch. Vet. Nauk, St. Petersburg, 28 (1898), No. 12, II pp. 561–568*).—Observations upon a number of cases of tetanus in which these substances were used.

Changes in the properties of the blood of animals which have been injected with the blood or serum of another species of animal in relation to Ehrlich's theory of immunity, F. Y. Chistovich (*Russk. Arch. Patol. Klin. Med. i Bakt., 8 (1899), No. 1, pp. 21–37*).—Results were obtained which tend to confirm the observations of Wassermann and Ehrlich on the preexistance of antitoxines in normal cells. The literature of the subject is discussed in connection with a bibliography.

The problem of serum therapy, J. Danysz (*Przegl. Weterynarski, 14 (1899), No. 4, pp. 97–107*).—An experimental study of the effect of the bile and blood serum of diseased animals when injected into healthy animals.

Preventive and curative sera derived from animals which have been immunized against hog cholera, K. Z. Kleptzov (*Arch. Vet. Nauk, St. Petersburg, 28 (1898), No. 11, II, pp. 501–509*).—A discussion of experiments conducted by the author upon hog cholera

Investigations on the toxicity of normal emulsified tissues when injected into the animal organism by the intravenous method, D. J. Mut (*Gac. Méd. Vét., Madrid, 24 (1900), No. 15, pp. 3–11*).—Emulsions of cerebral pulmonary or hepatic tissue injected into the veins produced cardiac paralysis. The same emulsions when boiled were inactive. Emulsions of the muscular tissue and of the spleen, kidney, thyroid gland, and suprarenal capsule were inactive. A repetition of doses of emulsions from active organs produced immunity against their action.

The reaction of the animal organism toward the blood serum of other animals, H. Friedenthal and M. Lewandowsky (*Arch. Anat. u. Physiol., Physiol. Abt., 1899, Sup. 1, pp. 531–543*).—The general results of the authors' study may be briefly summarized as follows: The blood sera of the different sexes do not differ from each other in any respect. The serum of one species, when injected into the blood of another species, produces poisonous effects of varying degrees of intensity. Upon heating the serum for a considerable time to a temperature of 60° C., its poisonous principle is destroyed.

Intravenous injections, P. Chaussée (*Rec. Méd. Vét., Paris, 8. ser., 6 (1899), No. 23, pp. 721–734*).—Experiments with antitetanic and antistreptococcic sera. The author concludes that the intravenous method has the following advantages: The immediate and complete diffusion of the serum through the body, a less dilution of the serum, and the avoidance of the ordinary complications of abscess.

Incubation period of contagious diseases of animals and nullification of the

sale in such cases, V. Galtier (*Jour. Méd. Vét. et Zootech., 5. ser., 3 (1899), pp. 697-703*).—A discussion of the periods of incubation in different diseases as affecting the sale of animals in which contagious diseases develop after being sold and removed to new quarters.

The question of governmental regulation of the inoculation of animals with preventive vaccines, N. Dikovski (*Vyestnik Obsh. Vet., 10 (1898), No. 12, pp. 447-450*).

Disinfection by means of formaldehyde after the occurrence of infectious diseases, M. T. Meshchadimenko (*Russk. Arch. Patol. Klin. Med. i Bakt., 8 (1899), No. 1, pp. 37-51, fig. 1*).—A detailed account of experiments in the use of formaldehyde gas for disinfection purposes, during which the action of this gas upon a number of pathogenic organisms was studied. A bibliography of the literature of the subject is added to the article.

Phototherapy, S. S. Evsyeenko (*Arch. Vet. Nauk, St. Petersburg, 28 (1898), No. 7, II, pp. 221-230*).—A discussion of the practical value of the application of X-rays in veterinary practice.

The illumination of stables for domestic animals and its influence upon diseases of the eye, Tomarov (*Arch. Vet. Nauk, St. Petersburg, 29 (1899), No. 11, pp. 552-555*).—Animals which are being fattened should be kept in more dimly lighted quarters than animals which are to be used for work purposes.

Contagious diseases of animals, A. G. Hopkins (*Rpt. Farmers' Inst. Manitoba 1899, pp. 8-10*).—Notes on a number of the more common animal diseases.

Cattle plague, I. Gordzyalkovski (*Vyestnik Obsh. Vet., 11 (1899), No. 9, pp. 390-396*).—A discussion of the symptoms and etiology of the disease, with an account of experiments with bile and blood serum in producing immunity.

The present scourge of cattle raising, Y. Polferov (*Vyestnik Obsh. Vet., 10 (1898), No. 9, pp. 327-329*).—A discussion of the cattle plague.

Concerning actinomycosis, Preusse (*Arch. Anat. u. Physiol., Physiol. Abt., 1899, Sup. 1, pp. 255-273, figs. 3*).—A discussion of the nature and prevalence of this disease in animals, with an account of the frequency of human infection.

The history of the development of actinomyces in pus of cattle, D. Korsak (*Arch. Vet. Nauk, St. Petersburg, 28 (1898), No. 1, II, pp. 20-24, pls. 2*).—A detailed account of the different stages in the development of this organism, many of which are figured.

The bacteriology of anthrax, N. N. Mari and S. L. Schensnovich (*Russk. Arch. Patol. Klin. Med. i Bakt., 7 (1899), No. 5, pp. 490-493*).—A report upon a technical study of the anthrax bacillus with reference to its growth upon various culture media.

The biology and method of contagion of anthrax, P. N. Andreev (*Arch. Vet. Nauk, St. Petersburg, 28 (1898), No. 10, II, pp. 395-418; No. 11, II, pp. 443-480; No. 12, II, pp. 513-553*).

Plasmolysis in the anthrax bacillus in relation to the question of the cell wall of bacteria and the brownian movement, V. V. Podvuisotzki and V. A. Taranukhin (*Russk. Arch. Patol. Klin. Med. i Bakt., 5 (1898), No. 6, pp. 653-662, pl. 1*).—A technical bacteriological study.

The influence of different conditions upon the increased virulence or attenuation of virulent anthrax cultures and anthrax vaccines in relation to their action upon living animals which have been inoculated with them, I. N. Kovalevski (*Arch. Vet. Nauk, St. Petersburg, 28 (1898), No. 7, II, pp. 255-281*).—An elaborate study of the influence of temperature and other conditions of increasing or diminishing the virulence of anthrax cultures, together with clinical notes upon the effects of such cultures upon animals.

The influence of lecithin and of organic substances which contain lecithin on the biology of the anthrax bacillus, V. A. Taranukhin (*Russk. Arch. Patol. Klin. Med. i Bakt., 6 (1898), No. 1, pp. 1-3*).—Lecithin was found to have a decidedly stimulating effect on the growth of the anthrax bacillus.

The diagnosis of anthrax, ARNDT (*Berlin. Tierärztl. Wchnschr., 1899, No. 52, pp. 624–628*).—A detailed discussion of the symptoms of anthrax and of those diseases with which it might be confused.

Further proof of the action of creolin against anthrax, HANSEN (*Berlin. Tierärztl. Wchnschr., 1899, No. 49, p. 591*).—An outbreak of anthrax was treated with creolin, 30 grains being given as a dose at first. Later another dose of 20 grains was given. Several cases were treated in this way with complete recovery as the result.

The problem of the disinfection of the soil in case of anthrax, A. E. TYURMORYEZOV (*Arch. Vet. Nauk, St. Petersburg, 28 (1898), No. 6, II, pp. 177–185*).—A report upon extensive experiments undertaken for the purpose of determining the most practical and effective method of destroying the organism of anthrax within the soil.

The importance of tuberculin in the diagnosis of tuberculosis, D. VAN DER SLUIJS (*Tijdschr. Veeartsenijk en Veeteelt, 26 (1898), No. 1, pp. 19–26*).—An experimental investigation of the reaction to tuberculin.

The use of the flesh of tuberculous animals, D. A. DE JONG (*Jour. Comp. Path. and Ther., 12 (1899), No. 4, pp. 315–325*).—Recommends the inspection of animals intended for food, and the condemnation of all cases of acute miliary tuberculosis and cases in which tuberculous lesions are present in the muscular tissue or its lymphatic glands. Condemned meat and condemned organs should be sterilized provided the commercial value of the meat after sterilization is not less than the cost of the process.

Cattle, A. MACKAY (*Canada Expt. Farms Rpts. 1898, pp. 368, 369*).—Statistics are given of the cattle kept at the Indian Head Experimental Farm as well as of the tests made in the herd for tuberculosis. Of 52 animals tested only 2 reacted.

Long persistence of the bacillus of Koch in the nasal passages of the guinea pig, P. VIOLLET (*Compt. Rend. Soc. Biol. Paris, 11. ser., 1 (1899), No. 39, pp. 996–998*).—The tubercle bacillus may live almost indefinitely upon the mucus membranes of the nose.

Hematuria of cattle, O. MAKAROV (*Arch. Vet. Nauk, St. Petersburg, 28 (1898), No. 10, II, pp. 137–142*).—A discussion of the symptoms of this disease, together with observations upon the effects of various drugs in controlling them.

Toxæmic hemoglobinuria of cattle, I. KACHINSKI (*Vyestnik Obsh. Vet., 11 (1899), No. 13, pp. 564–569*).—An experimental study of the symptoms and etiology of this disease.

Preventive inoculation for epizootic pneumonia, G. KOTLUBAI (*Vyestnik Obsh. Vet., 11 (1899), No. 16, pp. 677–681*).—Excellent results are reported from this treatment.

The organism of epizootic pleuro-pneumonia of cattle, NOCARD and ROUX (*Arch. Vet. Nauk, St. Petersburg, 28 (1898), No. 5, II, pp. 139–155*).—A detailed record of experimental work on this disease.

Parturient apoplexy of cows, L. IVANOV (*Arch. Vet. Nauk., St. Petersburg, 29 (1899), No. 11, pp. 561–564*).—An account of the symptoms etiology, and course of the disease. Treatment with potassium iodid is recommended.

Prophylaxis of lungworm disease, T. KASPAREK (*Arch. Wiss. u. Prakt. Thierh., 26 (1900), No. 1, pp. 70–73*).—An outbreak of the disease among calves was studied, and it was found that in order to prevent the spread of the disease, it was necessary to disinfect the stalls and destroy the old wood in such places.

Effects on cattle of eating macrozamia roots, J. H. MAIDEN (*Agr. Gaz. New South Wales, 10 (1899), No. 12, p. 1259*).—This plant is greedily eaten by cattle and is said to produce "rickets."

Dehorning cattle, F. GILLANDERS (*New Zealand Dept. Agr. Rpt. 1899, p. 170. pls. 2*).—The method of dehorning cattle at the Momohaki Experiment Station is described.

Sarcosporidiasis among buffalo (*Arch. Vet. Nauk., St. Petersburg, 28 (1898), No. 9, II, pp. 357–368*).—An account of the Sporozoa which live parasitically in buffaloes, including the genera Miescheria, Carcocystis, and Balbiania.

Sheep scab (*Jour. Bd. Agr.* [*London*], *6* (*1899*), *No. 3, pp. 346–349, figs. 2*).—Notes on *Psoroptes communis* and *Melophagus ovinus*.

Treatment of sheep scab, V. GRIGOREV (*Vystnik Obsh. Vet.*, *11* (*1899*), *No. 1, pp. 6, 7*).—Recommends for hand treatment a remedy containing corrosive sublimate, alcohol, oil of terebinth, and pine tar.

The transportation of wool from sheep which have been affected with sheep pox, V. AMELIN (*Vyestnik Obsh. Vet.*, *11* (*1899*), *No. 18, pp. 765–767*).—A discussion of the danger of spreading the disease in this manner.

Vaccination against sheep pox, V. AMELIN (*Vyestnik Obsh. Vet.*, *11* (*1899*), *Nos. 11, pp. 477–481*; *12, pp. 525–528*).—A detailed account of experiments conducted in the prevention of sheep pox by serum inoculation.

Hemaglobinemia of sheep, LE BLANC and SAVIGNÉ (*Jour. Med. Vet. et Zootech.*, *5. ser.*, *3* (*1899*), *pp. 703–710*).—This is a report of an experimental study of the disease in sheep. The pathogenic organism is apparently carried from animal to animal by means of insects. Santonin or sulphate of quinin and subcutaneous injections of methylene blue gave good results as treatment for the disease.

Epizootic pneumonia in goats, V. MATVYEEV (*Uchen. Zapiski Kazan. Vet. Inst.*, *15* (*1898*), *No. 5–6, pp. 315–324*).—A study of the symptoms, etiology, and treatment of pneumonia in goats.

Epizootic diseases of the reindeer, N. I. EKKERT (*Arch. Vet. Nauk, St. Petersburg*, *28* (*1898*), *Nos. 1, III, pp. 1–31; 2, III, pp. 51–99*).—An elaborate account of the diseases which are known to affect reindeer, with a discussion of the literature of the subject and a bibliography.

The transmission of hog cholera to man, CASPER (*Deut. Thierärztl. Wchnschr.*, *7* (*1899*), *No. 50, pp. 445, 446*).—A description of the symptoms and course of the disease in four cases.

Hog cholera, K. Z. KLEPTZOV (*Arch. Vet. Nauk.*, *St. Petersburg*, *28* (*1898*), *No. 1, II, pp. 10–20*).—An account of serotherapy in this disease.

Inoculation against hog cholera with the Landsberg serum, SCHREIBER (*Berlin. Tierärztl. Wchnschr.*, *1899*, *No. 51, pp. 611–613*).

The use of "Susserin" in hog cholera, M. CASPER (*Deut. Thierärztl. Wchnschr.*, *7* (*1899*), *No. 51, pp. 453–456*).—This remedy, having been tested by inoculation of more than 60,000 hogs, is reported to be cheap and effective.

An investigation of preventive vaccines for hog cholera, I. GORDZYALKOVSKI (*Vyestnik Obsh. Vet.*, *10* (*1898*), *No. 11, pp. 404–406*).—A statement of the results obtained from a practical application of preventive inoculation.

Hemorrhagic septicæmia (swine plague), N. N. MARI and A. I. AGAREV (*Arch. Vet. Nauk, St. Petersburg*, *28* (*1898*), *No. 1, II, pp. 1–10*).—An experimental study of swine plague, with observations upon guinea pigs which were inoculated with the disease.

Morphology of bacillus mallei, A. KRAEVSKI (*Vyestnik Obsh. Vet.*, *11* (*1899*), *No. 8, pp. 341–345*).—A bacteriological investigation, with a discussion of the relationship of the glanders bacillus to other organisms.

The natural recovery of horses from glanders, V. M. SULIN (*Arch. Vet. Nauk, St. Petersburg*, *28* (*1898*), *No. 4, II, pp. 119–122*).—From careful clinical records kept upon the cases of glanders, this is believed to occur occasionally.

The problem of controlling glanders on the steppes, V. KOLPAKOV (*Vyestnik Obsh. Vet.*, *11* (*1899*), *No. 5, pp. 206–210*).—A record of work done, with an account of the difficulties of the problem.

Epizootics of glanders along the frontiers of the government of Saratov, F. BEREZOV (*Vyestnik Obsh. Vet.*, *10* (*1898*), *Nos. 2, pp. 47–51; 3, pp. 87–91; 4, pp. 127–131*).—A detailed study of several outbreaks of glanders.

Glanders, and sanitary regulations, O. LEBRUN (*Rev. Vet. Toulouse*, *25* (*1900*), *No. 1, pp. 31–33*).—Discusses the danger of human infection by glanders, and recommends the annual inspection of all horses and mules by veterinarians.

Fighting glanders in St. Petersburg and the surrounding country in 1897,

S. Samborski (*Vyestnik Obsh. Vet., 10 (1898), No. 14, pp. 528–530*).—An account of regulations adopted and enforced against glanders.

The diagnostic value of mallein in detecting glanders in horses, I. N. Potapenko (*Arch. Vet. Nauk, St. Petersburg, 28 (1898), Nos. 6, II, pp. 203–219; 7, II, pp. 237–254*).—A critical discussion of the literature of the subject, and a report of observations upon the reliability of mallein as a test for glanders.

Materials for the study of the mallein problem, A. A. Kraevski (*Arch. Vet. Nauk, St. Petersburg, 29 (1899), Nos. 10, pp. 495–516; 11, pp. 519–538.*)—In this article the author presents a historical review of the literature on mallein in connection with a bibliography of 216 titles. Experimental investigations were conducted upon the subject of the reaction of horses to mallein and the factors which modify this reaction.

The problem of the influence of the sex of horses upon their susceptibility to disease, A. Ryazhev (*Arch. Vet. Nauk, St. Petersburg, 29 (1899), No. 11, pp. 539–552*).—A statistical account of the relative frequency of various diseases in geldings and mares. The frequency was found to be greater in the former than in the latter.

The presence of the botfly larvæ in the nasal cavities of horses mistaken for glanders, D. Polyakov (*Arch. Vet. Nauk, St. Petersburg, 28 (1898), No. 5, II, pp. 173–175.*)—A record of the symptoms of a number of cases, with suggestions which help in distinguishing the irritation caused by botfly larvæ from glanders.

Observations on the transmission and treatment of epizootic pleuro-pneumonia of horses, I. N. Potapenko (*Arch. Vet. Nauk, St. Petersburg, 28 (1898), No. 2, II, pp. 25–39*).—An account of the etiology and methods of contagion in this disease.

The diagnosis of periodical iritis of horses, S. A. Gryuner (*Arch. Vet. Nauk, St. Petersburg, 28 (1898), No. 2, II, pp. 47, 48*).—A discussion of the various forms and the etiology of iritis in horses.

Distemper and rabies, D. V. Devel (*Arch. Vet. Nauk, St. Petersburg, 28 (1898), No. 3, II, pp. 65–79*).—A discussion of the difficulties attending a reliable differential diagnosis of these two diseases.

The pathological anatomy and bacteriology of canine distemper, Y. N. Petropavlovski (*Russk. Arch. Patol. Klin. Med. i Bakt., 7 (1899), No. 6, pp. 597–620*).—By means of microscopic examinations it was possible to demonstrate the presence of the specific bacillus of canine distemper in the lungs, liver, spleen, submaxillary glands, mesenterical glands, and in pustules found in the skin.

Hypodermical injections of pure culture of the bacillus in young dogs produced the symptoms of canine distemper. The same result was obtained by inoculation of mice and guinea pigs. The lungs and liver were the first organs to become infested with the bacillus.

The infusoria which live in the stomach of ruminants, W. Kulczycki (*Przegl. Weterynarski, 14 (1899), Nos. 7, pp. 193–197; 8–9, pp. 218–235, figs. 15*).—Detailed notes on the occurrence and physiological or pathological effects in the stomach of ruminants of 12 species of infusoria.

An improved apparatus for hypodermic injection, Carl (*Deut. Tierärztl. Wchnschr., 7 (1899), No. 49, p. 437, figs. 3*).—A description of a needle which is free in a great degree from the disadvantages of the ordinary instrument for this purpose.

AGRICULTURAL ENGINEERING.

The homemade windmills of Nebraska, E. H. Barbour (*Nebraska Sta. Bul. 59, pp. 79, figs. 79*).—This bulletin gives sketches of typical windmills, built by farmers in Nebraska, accompanied by brief descriptions. It is the first of a proposed series of bulletins, the object of which is "to bring together views of a number of mills, and to compile facts about their uses, construction, cost, and durability which may be of possible use to prospective builders, and by which they may be enabled to select the design which seems to them least faulty or best suited to their individual wants."

It is stated that homemade mills are extensively used on the western plains. "They extend in almost unbroken succession from Omaha to Denver, and from South Dakota through Nebraska, Kansas, and Oklahoma," Nebraska being plainly the center of the movement. It is the experience of those using such mills that they are cheap, useful, and durable. The windmills described in this bulletin are classified as jumbo windmills, merry-go-round windmills, and turbine windmills. The bulletin also contains some discussion of uses of shop-made windmills and other water lifters, storage of windmill power, and transmission of windmill power, and gives a list of miscellaneous papers by the author on homemade windmills of Nebraska.

The annual work of a windmill, H. D'ANCHALD (*Jour. Agr. Prat., 1899, II, No. 45, pp. 677, 678*).

STATISTICS—MISCELLANEOUS.

Tenth Annual Report of Arizona Station, 1899 (*Arizona Sta. Rpt. 1899, pp. 225–262, pls. 2*).—This contains the organization list of the station; reports of the director, chemist, botanist, agriculturist and horticulturist, and meteorologist, reviewing the work of the station for the year and including articles noted elsewhere; and a financial statement for the fiscal year ended June 30, 1899.

Eleventh Annual Report of Connecticut Storrs Station, 1898 (*Connecticut Storrs Sta. Rpt. 1898, pp. 248*).—The report contains the board of trustees and officers of the station, a financial statement for the fiscal year ended June 30, 1898, a brief review of station work by the director, and a number of articles abstracted elsewhere.

Eleventh Annual Report of Kansas Station, 1898 (*Kansas Sta. Rpt. 1898, pp. XVII*).—This includes financial reports of the treasurer and secretary for the fiscal year ended June 30, 1898, a summary of Bulletins 76–80 of the station, a brief review of station work in progress, the organization list of the station, and a subject list of previous publications. Reprints of Bulletins 76–80 of the station on the following subjects are appended: Fifth report on Kansas weeds—vegetative propagation of perennial weeds (E. S. R., 10, p. 359), some insects injurious to the orchard (E. S. R., 10, p. 369), sugar beets (E. S. R., 10, p. 346), bovine tuberculosis (E. S. R., 10, p. 395), and sixth report on Kansas weeds—distribution and other notes (E. S. R., 10, p. 646).

Twelfth Annual Report of Maryland Station, 1899 (*Maryland Sta. Rpt. 1899, pp. IX+212*).—In addition to brief notes on the work of the station, a meteorological summary for 1898, and a financial statement for the fiscal year ended June 30, 1899, the report contains reprints of Bulletins 57–62 of the station on the following subjects: Report on the San José scale in Maryland and remedies for its suppression and control (E. S. R., 10, p. 868), the Hessian fly and wheat diseases (E. S. R., 10, pp. 864, 872), sweet potato insects (E. S. R., 11, p. 52), some diseases of the sweet potato (E. S. R., 11, p. 260), the sugar beet in Maryland (E. S. R., 11, p. 441), experiments with wheat, corn, and potatoes (E. S. R., 11, p. 440).

Eleventh Annual Report of Mississippi Station, 1898 (*Mississippi Sta. Rpt. 1898, pp. 13+57*).—Contains the organization list of the station, a brief review of station work by the director, a meteorological report noted elsewhere, and a financial statement for the fiscal year ended June 30, 1898. Reprints of Bulletins 43, 44, 49, and

50 of the station on the following subjects are appended: Natural plant food, claims made for it and its value (E. S. R., 9, p. 1043), winter pasture (E. S. R., 9, p. 1048), analyses of commercial fertilizers (E. S. R., 10, p. 428), winter and summer pasture in Mississippi (E. S. R., 10, p. 547).

Tenth Annual Report of Nevada Station, 1897 (*Nevada Sta. Rpt. 1897, pp. 29*).—The different lines of station work are reviewed by the director and heads of departments, and a financial statement is given for the fiscal year ended June 30, 1897.

Twelfth Annual Report of New York Cornell Station, 1899 (*New York Cornell Sta. Rpt. 1899, pp. XXI+711*).—The report proper contains the organization list of the station and brief reports by the director, treasurer, and heads of departments. Appendix I is made up of reprints of Bulletins 150–170 of the station on the following subjects: Tuberculosis in cattle and its control (E. S. R., 10, p. 596), gravity or dilution separators (E. S. R., 10, p. 591), studies in milk secretion (E. S. R., 10, p. 885), impressions of our fruit-growing industries (E. S. R., 10, p. 959), tables for computing rations for farm animals (E. S. R., 10, p. 992), San José scale (E. S. R., 10, p. 975), third report on potato culture (E. S. R., 10, p. 950), the grape-vine flea-beetle (E. S. R., 10, p. 1073), source of gas and taint-producing bacteria in cheese curd (E. S. R., 10, p. 1093), an effort to help the farmer (E. S. R., 10, p. 1098), hints on rural school grounds (E. S. R., 11, p. 50), annual flowers (E. S. R., 11, p. 49), the period of gestation in cows (E. S. R., 11, p. 81), fungus diseases of the sugar beet (E. S. R., 11, p. 162), peach-leaf curl (E. S. R., 11, p. 161), ropiness in milk and cream (E. S. R., 11, p. 282), sugar-beet investigations for 1898 (E. S. R., 11, p. 237), the construction of the stave silo (E. S. R., 11, p. 294), studies and illustrations of mushrooms, II (E. S. R., 11, p. 322), studies in milk secretion (E. S. R., 11, p. 381), tent caterpillars (E. S. R., 11, p. 368). Appendix II gives a detailed statement of receipts and expenditures of the station for the fiscal year ended June 30, 1899. Appendix III contains reprints of publications on nature study.

Ninth Annual Report of North Dakota Station, 1898 (*North Dakota Sta. Rpt. 1898, pp. 36*).—This contains the board of trustees and staff of the station; a financial statement for the fiscal year ended June 30, 1898; brief reports by the director and heads of the departments of agriculture, horticulture, and dairying; and more extended reports by the chemist, botanist, and veterinarian, noted elsewhere.

Seventh Annual Report of Washington Station, 1897 (*Washington Sta. Rpt. 1897, pp. 8*).—This includes the board of control and station staff, a brief review of station work by the director, and a financial statement for the fiscal year ended June 30, 1897.

Practical value of the work of the experiment station, H. J. WATERS (*Missouri Sta. Circ. of Information 9, pp. 7*).—Results obtained in some of the more important lines of work carried on at the station are briefly mentioned.

List of reports and bulletins published up to December 31, 1898 (*Indiana Sta. Circ. 1, pp. 8*).—Subject list of publications of the school of agriculture from 1885 to 1887 and of the station since 1888.

Crop circular for September, 1899, J. HYDE (*U. S. Dept. Agr., Division of Statistics Crop Circ., Sept., 1899, pp. 4*).

Crop circular for November, 1899, J. HYDE (*U. S. Dept. Agr., Division of Statistics Crop Circ., Nov., 1899, pp. 4*).

The rice industry, J. SHOMAKER (*Irrig. Age, 14 (1900), No. 5, pp. 170, 171*).—A note on the status of this industry in the United States at the present time.

Agriculture in Holland (*Jour. Bd. Agr. [London], 6 (1899), No. 3, pp. 369–373*).—Statistical data on area under cultivation, crop production, wages, etc.

Agricultural education in rural schools—a suggested English scheme (*Farmers' Gaz., 58 (1899), No. 52, pp. 1132, 1133*).

Agricultural education (*Nature, 61 (1900), No. 1579, pp. 332, 333*).—Suggestions for the elementary teaching of agriculture in England.

Report of committee respecting the establishment of an agricultural department and experiment station (*Jour. Jamaica Agr. Soc., 4 (1900), No. 1, pp. 30–45*).

NOTES.

Connecticut State Station.—B. W. Collins, of Meriden, has been elected a member of the board of control for a period of two years in place of S. M. Wells, whose term of office has expired.

Georgia Station.—A. V. Deadwyler, member of the board of directors of the station, has resigned, and John Deadwyler has been appointed his successor. The horticultural department of the station has undertaken tests of the culture of hybrid oranges furnished by this Department, and has begun experiments in tea culture.

Mississippi College.—At a recent meeting of the board of trustees J. C. Hardy, formerly superintendent of the public schools of Jackson, was elected president of the college to succeed J. M. Stone, deceased.

Missouri College and Station.—The station has just forwarded to Texas four carloads of northern pure-bred cattle, both bulls and heifers. These cattle have been at Columbia for the past three months being inoculated against Texas fever, and have recovered in good condition from the inoculation fever. Two additional carloads from northern Missouri have just been received and will be inoculated at once. The college now has in training, under the direction of Dr. Connaway, three or four young men who are doing the actual work of inoculating and nursing the cattle and who will soon have the requisite experience to conduct such work alone.

New Mexico College and Station.—John J. Vernon, formerly assistant horticulturist in the Iowa Agricultural College and Experiment Station, has been appointed agriculturist in this college and station.

Cornell University.—Arrangements have been made for a course in fish culture in connection with the college of forestry. The course will occupy two weeks, beginning May 7, and will be given at Axton in the college forest in the Adirondacks. It will be under the direction of Prof. Barton W. Evermann, of the United States Fish Commission, and will consist of a series of daily lectures, with laboratory work, field excursions, and visits to the State fish hatchery at Clearwater.

Tennessee University and Station.—The horticultural department has planted an experimental orchard of Tennessee seedling apples and standard varieties of apples, peaches, pears, plums, cherries, and quinces, with representative collections of small fruits. The plantation covers 5 acres of high ridge land, and exemplifies both contour and straight-row planting. The chemical department has been making analyses of cultivated soils from the more important type soils throughout the State, and has been conducting cooperative fertilizer experiments along with the chemical work. The department of agriculture has recently issued an illustrated handbook containing articles on agricultural instruction in the University of Tennessee and on the experimental work of the agricultural department, and chapters on dairying, the orchard, soil and its culture, forage, and botanical work. The object in publishing this book is to give the farmers much needed practical information that can not be secured in the station publications, and to bring them in closer touch with the college of agriculture and the experiment station work.

Utah College and Station.—J. M. Tanner, president of the college, has resigned. The following have been appointed members of the board of trustees:

P. W. Maughan, secretary, *vice* Joseph E. Wilson, resigned, and John A. McAlister, of Logan, *vice* M. W. Merrill, resigned.

VIRGINIA STATION.—Capt. C. E. Vawter has resigned as a member of the governing board. At the recent session of the legislature the governing board of the station was made a board of crop pest commissioners for the eradication of insect enemies and fungus diseases of fruit trees.

WISCONSIN UNIVERSITY AND STATION.—A central heating plant is being completed which will furnish steam heat to the dairy building, the horticultural building with its greenhouses, and to the proposed central agricultural building which it is planned to locate near these two structures. Over the boiler room proper is a two-story structure 30 by 50 ft., which will afford increased accommodations for dairy school instruction. On the first floor will be placed steam engines, pumps for instruction purposes, etc., while the second will furnish accommodations for instruction in pipe cutting, belt lacing, soldering, etc. It has been found desirable to give dairy pupils drill in these lines in order to increase their efficiency in the practical operation of creameries and cheese factories. The structure is of white brick with red brick trimmings and cherry-red tile roof. Plans are now being made for an addition to the dairy building which will provide rooms for the manufacture of Swiss and other varieties of foreign cheese and for the curing and care of cheese. Special rooms are being arranged for a continuation of investigations which are in progress to ascertain the proper temperatures, moisture content, etc., for cheese-curing rooms.

SCHOOL OF FORESTRY AT YALE UNIVERSITY.—A donation of $150,000 has been made to Yale University for the establishment of a school of forestry by Mr. and Mrs. J. W. Pinchot and their sons, Gifford and A. R. Pinchot. The donors also authorize the use of a large tract of land in Pennsylvania for a summer school of forestry. Henry S. Graves, assistant in the Division of Foresty of this Department, has been appointed professor of forestry.

SCHOOL OF APPLIED AGRICULTURE AND HORTICULTURE.—According to American Gardening (21 (1900), No. 270, p. 130), a school for scientific instruction and practical training in agriculture and horticulture is to be established near New York City in connection with the New York Botanical Garden. The matter is in the hands of a committee for the promotion of agriculture. A farm of nearly 200 acres, located at Chappaqua, 33 miles from New York City, has been secured by the committee, and the work of organizing the school will begin at once. The plan of the school, as outlined at a recent meeting of the committee at the house of Hon. Abram S. Hewitt, by George T. Powell of Ghent, N. Y., "embraces the study of scientific principles along elementary lines. Students will also be instructed in the practical details of the culture of plants, in the planting and care of orchards, small fruits, market-garden vegetables, greenhouse culture, dairy work, and poultry raising, getting the fullest knowledge of the best and most skillful methods that are necessary in the production of the finest products that command in all markets the highest value."

O

EXPERIMENT STATION RECORD.

VOL. XI. No. 10.

The investigation recently reported upon by the Missouri and Texas stations in combating Texas fever is an instance of a line of veterinary work in the legitimate province of the station veterinarians, which thorough and persistent investigation has brought to most successful issue. It is likewise a good illustration of the fundamental importance of research along lines which are more or less purely scientific, and the ultimate application of the results in practice.

The work of combating Texas fever has been in progress for a number of years. The Bureau of Animal Industry of this Department demonstrated it to be due to a protozoan blood parasite, and showed experimentally the agency of the cattle tick in carrying this organism and thereby infecting cattle with the disease. It was shown that the disease is not communicated by contact with a diseased animal, but only through infestation with infected ticks. Accordingly experiments were at first directed toward getting rid of the tick by dipping cattle in various materials. In this work the Missouri and Texas stations, as well as several other stations in the South, cooperated for a number of years. Southern cattle were dipped and then shipped North to determine whether they could be safely mixed with herds there, and Northern cattle were shipped South and then dipped for the purpose of preventing their infection by Texas fever. A single dipping was found insufficient to destroy all the ticks, and a frequent repetition of the process was found to be severe on the animals and not entirely effective.

Various attempts were made to render Northern cattle immune to the disease in a manner similar to that in which Southern cattle become immune, that is, by infestation with ticks. Such experiments led to the investigations which have had so successful an outcome. Following the discovery by the Bureau of Animal Industry of the immunizing effect of the blood from immune cattle, a method was worked out and given a practical test. The mild attack developed by a single inoculation was found to confer only partial immunity, which could be rendered complete by a subsequent inoculation.

The Bureau experiments reviewed in the present number were made with ten ordinary grade animals. The work reported by the Missouri and Texas stations was with over four hundred animals, mostly thoroughbreds, and under conditions which were a severe test of the efficacy and practical application of the treatment. In general, thoroughbred cattle are more susceptible to the disease than grade cattle, and from a practical point of view the introduction of high-bred stock into the regions infested by Texas fever is very desirable and has often been attempted. Hence, the work not only demonstrates the reliability of the method on a large scale, but carries with it the solution of an exceedingly important practical problem for the South.

In the present state of the method, when due care is exercised, the loss from inoculation fever or from the development of the disease on account of failure in producing immunity is so small that it may almost be neglected. The loss for all the animals inoculated was less than 8 per cent. When proper regard is had to the condition and age of the animals, to the climatic conditions, and to the care of the animals during the period from the inoculation to complete recovery from the inoculation fever, the method is thoroughly reliable. Northern cattle may be taken into infested regions in winter and under proper precautions immunized in the South, or they may be inoculated and rendered immune in the North before shipment.

The economic importance of this discovery is apparent when it is considered that under ordinary conditions from 40 to 70 per cent of Northern cattle shipped into the infested regions die from the attack of Texas fever. This high rate of mortality has greatly hindered the shipment of high-bred Northern cattle to the Southern States for breeding purposes and for the improvement of beef and dairy herds. Repeated attempts have been made to introduce thoroughbred bulls into Southern herds, but so often with disastrous results as to discourage attempts in this direction. This has exercised a very marked effect on the grade of cattle kept in the South, especially the dairy cattle, and has retarded the development of the dairy industry in that section. The removal of this barrier will probably do more toward promoting the dairy interests of the South than any other single factor in the problem.

RECENT WORK IN AGRICULTURAL SCIENCE.

CHEMISTRY.

The chemical analysis of phosphate rock, O. A. MOOERS (*Univ. Tennessee Record, 1899, No. 11, pp. 252–255*).—This is an account of a critical study of methods for the complete analysis of mineral phosphates, with recommendations for their improvement. The official molybdic method for the determination of phosphoric acid was used.

> "For the estimation of iron and aluminum oxids the filtrate from the yellow precipitate of ammonium phosphomolybdate is diluted to about 800 cc. and the iron and aluminum precipitated by ammonia. The precipitate after boiling is allowed to settle so that the liquid can be decanted through a filter paper. The precipitate is then added, and after being washed once or twice, is dissolved into the precipitating beaker with dilute HCl. This solution of chlorids is now made up to about 250 cc., 5 cc. of strong HCl added, and the iron and aluminum again carefully precipitated. The third precipitate in this manner is washed free of chlorin, dried and burned, and weighed as iron and aluminum oxids"

A rapid method for the determination of clay in soils, F. POQUILLON (*Bul. Soc. Chim. Paris, 3. ser., 23 (1900), No. 4, pp. 115, 116*).—In the method proposed 10 gm. of the soil is rubbed up with the finger in a porcelain crucible, water being added drop by drop until the volume reaches about 25 cc. The contents of the crucible are then washed into a 150 cc. beaker containing from 100 to 120 cc. of dilute ammonium hydroxid solution (1 gm. per liter). The mixture is stirred with a glass rod, allowed to stand 5 minutes, and the supernatant liquor decanted into a liter flask. From 100 to 125 cc. more of the solution of ammonium hydroxid is added to the residue, stirred, allowed to stand 5 minutes, and decanted as before. This operation is repeated until the liquid is clear, from 6 to 8 washings usually being sufficient even for soils richest in clay. The residue is then treated with dilute hydrochloric acid, washed with distilled water, and weighed, giving the amount of total sand. The washings containing the clay are treated with a few drops of hydrochloric acid to decompose the carbonates and coagulate the clay. The solution is allowed to stand until it becomes clear, which requires from 2 to 3 hours. The clay is then collected on a filter, washed with distilled water, dried, and weighed.

Comparative tests of this and other methods for determining clay indicate that it is fully as accurate and much more rapid than the other methods.

A reducing and invertible sugar obtained from cornstalks, C. ISTRATI and G. OETTINGER (*Bul. Roumaine, 8, pp. 325–351; abs. in Chem. Centbl., 1900, I, No. 1, p. 43*).—In 1897 the authors reported the content of reducing and invertible sugar in the stalks of 13 varieties of corn grown in Bucharest. The present article reports the results for 16 varieties grown in 1898. The object was to determine not only the total quantity of sugar, but the period of growth at which the greatest amount of sugar was present, and the variety best suited to serve as a substitute for the sugar beet. Up to the seventieth day of growth of the plant the juice was nearly always levorotatory, but from that time on it was dextrorotatory.

The article contains detailed tabular statements on the composition of the maize juice, which are not reproduced in the abstract.

Determination of fat in milk, R. LÉZÉ (*Ann. Chim. Analyt. et Appl., 4 (1899), pp. 371, 372; abs. in Chem. Centbl., 1900, I, No. 1, p. 69*).—The following method, based on Ramschen's, has been worked out: In a flask of 50 to 60 cc. capacity, graduated to 0.1 cc., place 36 cc. of milk and 10 cc. of a mixture prepared by dissolving 8 gm. of caustic potash in 10 cc. of pure ammonia, adding 55 cc. of ethyl alcohol and 15 cc. of amyl alcohol, and adding sufficient ammonia to make the volume 100 cc. The milk is digested with this mixture for 10 minutes on a boiling-water bath and warm water then added to bring the separated fat layer into the neck of the flask, reading off the fat layer at a temperature of 40° C. The volume of fat divided by 4 gives the grams of fat in 1 liter of milk.

The results with this method are said to agree well with those obtained by extraction.

Formalin in milk, A. LEYS (*Ann. Chim. Analyt. et Appl., 4 (1899), pp. 338–342; abs. in Analyst, 25 (1900), Feb., p. 37*).—Jorissen's test is the one principally relied upon in the municipal laboratory in Paris. In this 25 cc. of milk is shaken with 10 cc. of a solution of phloroglucin (1 gm. per liter), and subsequently with 5 to 10 cc. of potassium hydroxid. To eliminate the chances of error a preliminary test is made by shaking 10 cc. of the milk with 20 cc. of Adams's ammoniacal mixture of alcohol and ether. If the lower layer is completely opaque after a few seconds, the milk is regarded as having been boiled; a greenish tint with slight flocculence indicates annatto; a red coloration points to the presence of turmeric; while chrysoin gives the upper layer a golden yellow color, and the milk itself gives a reddish-brown tint on treatment with potassium hydroxid. The detection of formalin in the absence of these substances is confirmed by distilling the milk and testing the distillate with Gayon's reagent (1,000 cc. 0.1 per cent aqueous solution of fuchsin, 10 cc. sodium bisulphite solution (30° Bé.), and 10 cc. concentrated hydrochloric acid). The milk is also tested by Denigès's method (E. S. R., 8, p. 459).

Contribution on the albuminoid bodies of cows' milk, II, K. STORCH (*Monatsh. Chem., 20 (1899), pp. 837–846; abs. in Chem. Centbl.,* *1900, I, No. 2, p. 142*).—This continuation of the author's previous investigations (E. S. R., 9, p. 222) is confined to studies of the two phosphore-containing albuminoid bodies, *a* and *b*, previously obtained by saturating cows' milk with sodium sulphate, magnesium sulphate, or sodium chlorid, as a result of the cleavage of the caseinogen. The body *a* is believed to be a nucleoalbumin and *b* a nucleohiston. The preparation of the bodies in pure state is described, together with a long list of reactions and their elementary composition.

Chemical division, H. J. WHEELER (*Rhode Island Sta. Rpt. 1898, pp. 111-121*).—A brief synopsis is given of the work of the year, including fertilizer inspection, study of methods of analysis, field, pot, and greenhouse experiments, special chemical investigations, miscellaneous analyses (see p. 917), etc.

On a possible error in the determination of nitrogen in nitrates due to impurities in reduced iron, B. L. HARTWELL and H. J. WHEELER (*Rhode Island Sta. Rpt. 1898, pp. 204, 205*).—See E. S. R., 11, p. 311.

A general method for the determination of elements in organic compounds, BERTHELOT (*Compt. Rend. Acad. Sci. Paris, 129 (1899), pp. 1002-1005; abs. in Chem. Centbl., 1900, I, No. 5, p. 316*).—The author gives the means of determining the elements of a compound by combustion in the bomb calorimeter. The combustion in the bomb leads to practically the same results as ordinary combustion and incineration.

A new method for determining water in sirups and similar products, O. MOLENDA (*Oesterr. Ztschr. Zuckerind. u. Landw., 28 (1899), pp. 621-625; abs. in Chem. Centbl., 1900, I, No. 1, p. 71*).—The method depends upon the familiar decomposition process of calcium carbid with water, the acetylen generated being taken as an indication of the water content.

Detection of sawdust in flour, G. A. LEROY (*Ann. Chim. Analyt. et Appl., 4 (1899), pp. 212-221; abs. in Analyst, 25 (1900), Feb., p. 39*).—The author uses an acid solution of phloroglucin.

On the abnormally high polarization of some cane juices, H. C. PRINSEN-GEERLIGS (*Internat. Sugar Jour., 2 (1900), No. 15, pp. 145-153*).

The preparation in pure state and the separation of sugars, O. RUFF and G. OLLENDORFF (*Ber. Deut. Chem. Gesell., 32 (1899), pp. 3234-3237; abs. in Chem. Centbl., 1900, I, No. 1, p. 19*).—The authors recommend the substitution product benzyl phenylhydrazin as superior to phenylhydrazin.

A modification of Duclaux's method for determining solids and fat in milk and butter, U. MORINI (*Staz. Sper. Agr. Ital., 32 (1899), pp. 517-530; abs. in Chem. Centbl., 1900, I, No. 1, p. 69*).—Duclaux's method is said to be suited to the examination of butter which contains an unusually large amount of water and protein substances, but the author uses 20 gm. of butter instead of 2 to 3 gm. as recommended by Duclaux, and recommends for the extraction of the fat the apparatus described by O. Förster.[1]

In conclusion the author describes the method in detail and reports analyses showing the utility of the modified Duclaux method.

Annual report of the chemical laboratory of the city of Altona, 1898-99, A. REINSCH (*Abs. in Chem. Centbl., 1900, I, No. 5, p. 308*).—Of 187 samples of butter 24 contained over 16 per cent of water, and 16 had more than 20 per cent. By means of the sesame oil test 2 samples of butter with saponification numbers of 227.3 and 226.8 and Reichert-Meissl numbers of 24.98 and 25.48, respectively, were shown to be adulterated with oleomargarine; without this test the adulteration would not have been detected. The refractometer with Wollny's special thermometer was found to be of very little use as a preliminary test of butter.

Data are given for sausage, honey, wines, and other products examined.

---

[1] Ztschr. Analyt. Chem., 27 (1888), p. 30.

Retention of moisture by asbestos, G. AUCHY (*Jour. Amer. Chem. Soc., 22 (1900), No. 1, pp. 46, 47*).—The author calls attention to the fact that asbestos may retain moisture with such tenacity as not to be driven off by drying at 100° C., and points out the bearing of this in making determinations with the Gooch crucible. He recommends "either to get the preliminary weight of the Gooch crucible by drying the same length of time and at the same temperature as is intended with the precipitate, or, much more conveniently, to find once for all the weight of the moisture retained by the dried Gooch crucible and make the necessary correction when getting weights of precipitates."

On some analyses of modern "dry" champagne, O. ROSENHEIM and P. SCHIDROWITZ (*Analyst, 25 (1900), Jan., pp. 6-9*).—A tabulation of 13 analyses of this class of wines shows the unreliability of judging wines on purely analytical data.—G. W. SHAW.

The pectin of the quince, JAVILLIER (*Jour. Pharm. et Chim., 6. ser., 9 (1899), pp. 163-166, 513-515; abs. in Ztschr. Untersuch. Nahr. u. Genussmtl., 2 (1899), No. 12, pp. 932, 933*).—A chemical study of the pectin obtained from quince pulp.

The pectin of gooseberries, E. BOURQUELOT and H. HÉRISSEY (*Jour. Pharm et Chim., 6. ser., 9 (1899), pp. 281-286; abs. in Ztschr. Untersuch. Nahr. u. Genussmtl., 2 (1899), No. 12, p. 933*).—A chemical study of the pectin of the gooseberry.

BOTANY.

The probable cause of the poisonous effects of the darnel, P. GUÉRIN (*Bot. Gaz., 28 (1899), No. 2, pp. 136, 137*).—In the author's investigations upon seed integuments and the pericarp of grasses, he noted the practically constant presence in the seeds of the darnel of a fungus to which it seems reasonable to assign its poisonous effects. This fungus, which is always present in the form of a mycelium, appears at an early stage in the interior of the ovary. In the first stages of its development it is said to invade the entire nucellus, and at the time that the external integument of the ovule disappears the nucellus itself is almost entirely resorbed. These observations have been confirmed in other species of Lolium, although the fungus occurs rarely upon *L. perenne.*

The exact nature of the fungus is not yet definitely settled, but the author states that it can not be identified with *Endoconidium temulentum.* The latter fungus attacks the seeds of rye, which it seriously deforms, while darnel shows no such deformation.

The effect of algæ on greenhouse plants, A. MAURIZIO (*Flora, 86 (1899), No. 2, pp. 113-142, pl. 1*).—Attention is directed to a number of investigations on the effect of algæ on plants, especially the parasitic algæ of the Tropics, and deductions as to those growing on greenhouse plants are drawn.

The species most under investigation, which were on greenhouse plants exclusively, were *Pleurococcus vulgaris*, *Cystococcus humicola*, *Oscillaria tenuis*, *O. subtilissima*, *Stichococcus bacillaris*, *Chroococcus helveticus*, *Protococcus botryoides*, and *Merismopœdia elegans*. The plants attacked are divided into 3 classes: (1) those whose leaves have thin or poorly developed epidermis, among these the ferns; (2) plants with one or more layers of epidermal cells, in which cases injury is by covering the leaves with matted algæ; and (3) those with a very thick epidermis with little cuticularization.

The method by which each group of plants is affected is described at considerable length. One of the principal ways is by covering the plants to such an extent that the functions of the leaves are interfered with and the general vitality of the plant impaired.

A bibliography of the subject completes the paper.

The effect of static electricity on the roots of plants, A. LETELLIER (*Bul. Soc. Bot. France, 46 (1899), No. 1–2, pp. 11–23*).—By means of an especially arranged clinostat the author was enabled to investigate the effect of static electricity upon the roots of beans, the influence of gravity, moisture, temperature, and atmospheric electricity being eliminated. It was found under the conditions of the experiment that positive static electricity exerts a strong directive influence upon the primary and secondary roots of the bean. Negative static electricity also exerts a directive force, but less powerful. Both results may be platted in curves having opposite direction to that exerted by electrified disks.

Report of the agricultural-climatological station at Juvisy, C. FLAMMARION (*Bul. [Min. Agr. France], 18 (1899), No. 3, pp. 438–450, figs. 3*).—This report covers investigations on the effect of solar radiation on the growth of plants, the persistence of oak leaves under the influence of blue rays, the action of the different portions of the spectrum upon the coloration of plant tissues, the action of different portions of the spectrum upon the growth of silkworms, and the rate of transpiration in some plants.

The experiments on solar radiation as affecting the growth of plants are in continuation of those previously described (E. S. R., 10, pp. 103, 613), and are being conducted with special reference to uniformity in temperature and intensity of light. Plants were grown in different portions of the spectrum, in double bell jars, the space being filled with monochromatic solutions, and in houses furnished with different colored glass. As previously, the best growth was made in the red light, and intensity of light was found to play an unimportant rôle. Slight differences were observed, but in general both woody and herbaceous plants acted alike in their response to different light conditions.

In the above experiments with small oak trees grown in large pots, it was observed that the trees under the blue light retained their leaves far longer than the others. This is explained by the fact that blue light retarded the ordinary processes of growth, the chlorophyll being very slowly acted upon, the circulation rendered very sluggish, and the trees kept in a very low state of existence.

The color of plants was influenced to a marked degree by the different lights in which they were grown. Plants with bright foliage and flowers were grown for a time under different colored lights with a decided effect upon the clearness of their tints. This was true of Alteranthera, begonias, geraniums, Cobæa, verbenas, lobelias, and Tradescantia.

The action of different colored light upon silkworms was investigated by placing 15 worms of the same size under different colored lights and weighing them after about 5 weeks. Those grown under the orange light were the heaviest, followed by those grown under red, blue, black, and clear glass, respectively. The experiments are to be repeated.

The relative amount of water transpired by a lily flower and leaf was investigated. The weight of the flower was about 6 times that of the leaf, but the latter transpired in 24 hours 11 times as much water as the flower. The author thinks that the white color of the flower had considerable to do with the low transpiration. The transpiration of maize plants of 0.15 meter height when grown under monochromatic colors was studied. Those grown under the visible spectrum transpired most per gram weight of leaf, followed by those grown under total radiation, orange, red, pale blue, deep blue, green, and darkness under a lampblack screen.

The acquisition of atmospheric nitrogen by soil inoculation, W. M. MUNSON (*Maine Sta. Rpt. 1898, pp. 208–212*).—Experiments were conducted with red clover, peas, vetches, beans, and soja beans, with different kinds of Nitragin cultures. The experiments were conducted in a sandy subsoil placed in a tight box and sterilized by passing a steam coil for one hour through the soil.

The results for each plant are given in detail, and the general conclusion is drawn that the culture of the specific germ of any given type gave no better results than a culture of a nearly related type. In most cases plants from untreated pots were as vigorous as those from inoculated soil. The experiments thus far conducted do not warrant the recommendation of germ cultures for leguminous crops.

A trial of Nitragin, H. J. WHEELER and J. A. TILLINGHAST (*Rhode Island Sta. Rpt. 1898, pp. 186–191, fig. 1*).—The authors report experiments conducted with Nitragin, in which 4 plats containing 100 sq. ft. each, on which leguminous plants had not previously been grown for 20 years or more, were fertilized with 300 lbs. of muriate of potash and 800 lbs. of acid phosphate, and plats 3 and 4 received 300 lbs. per acre of air-slaked lime. The bacteria culture, after being warmed according to direction, was divided into 2 equal parts and thoroughly mixed with water at suitable temperature. One portion was sprinkled over plat 1, the other over plat 3. Four rows of American Wonder peas were planted in each plat. On July 29 the peas had made a full growth and were cut close to the ground, and their weights taken green. In each case the plats receiving no culture solution gave slightly the heavier yield. Examination of the roots of the plants showed that where inoculation had taken place the roots were covered with small tubercles, although on one of the check plats a number of nodules were distinguished.

Immediately after the removal of the first crop, a second crop of peas was planted with similar results. It was observed that even on the plats which received no Nitragin there were uniformly large numbers of tubercles upon the roots of the plants.

The authors state that the absence of any particular benefit in the case of the first crop was probably due to the presence of sufficient combined nitrogen in an assimilable form to supply the needs of the plants. In the second case the lack of apparent benefit was probably due to the above cause and to the fact that the organisms naturally present had multiplied to such an extent as to insure an abundant assimilation of atmospheric nitrogen without the intervention of those supplied by the Nitragin.

The flora of North Carolina, C. W. HYAMS (*North Carolina Sta. Bul. 164, pp. 290–365*).—A list is given of the flowering plants and higher cryptogams known to occur within the borders of the State. In all, 2,685 species are mentioned and their distribution in the different parts of the State indicated.

Notes on the plants of the year, F. L. HARVEY (*Maine Sta. Rpt. 1898, pp. 131–135*).—Notes are given on the plants received during the year for identification, from which it is thought that the farmers of the State are awakening to the importance of weeds, and the necessity of carefully watching their fields to prevent the introduction and spread of weeds. A large number of seeds are reported to have been examined during the past season, over 60 kinds of foreign weed seed having been detected.

Preliminary catalogue of plants poisonous to stock, V. K. CHESNUT (*U. S. Dept. Agr., Bureau of Animal Industry, Rpt. 1898, pp. 387–420, figs. 32*).—Most of the species here given are described in Bulletin 20 of the Division of Botany of this Department (E. S. R., 10, p. 516). The present catalogue includes a larger number of introduced and native plants which have been reputed as more or less poisonous to stock. Lists are given of plants which are claimed to be poisonous to stock, those probably poisonous, and those suspected of being injurious.

British parasitic flowering plants, J. SAUNDERS (*Trans. Herfordshire Nat. Hist. Soc., 10 (1899), No. 2, pp. 44–48*).—A list is given of the parasitic phanerogams occurring in Great Britain, together with their distribution and habitat.

Catalogue of herbarium specimens for exchange, C. W. HYAMS (*North Carolina Sta. Spec. Bul. 51, pp. 48*).—A list is given of duplicate specimens which are offered in exchange to other institutions or persons desiring them.

Plant structures, J. M. COULTER (*New York: D. Appleton, 1900, pp. VII+348, figs. 289*).—This book, which is termed a second book in botany, is supplemental to Plant Relations by the same author (E. S. R., 11, p. 709), and each is meant to represent a half year's work in secondary schools. While in Plant Relations ecology dominates the work, in this volume plant morphology is the keynote, and for those teachers of botany who believe morphology should come first in the course of study, the order of the two may be reversed. After tracing the evolution of the plant kingdom from the lowest to the highest, chapters are given on physiology, ecology, and taxonomy, in which the main facts are brought together. A brief glossary is appended in which the necessary terms are defined, but untechnical terms are used so far as possible.

The numerous illustrations of both Plant Relations and Plant Structures are to be studied as diligently as the text. In the study of botany the author states that "the book is merely intended to serve as a compact supplement to the three more important factors—the teacher, the laboratory, and fieldwork."

Pollination and fertilization of flowers, W. M. MUNSON (*Maine Sta. Rpt. 1898, pp. 218–229, pls. 5*).—The author undertook the study of some of the problems connected with the pollination of flowers, and the results given in a previous report of the station (E. S. R., 4, p. 544), since which time press of other duties has made it impossible to continue the work. Opportunity offering for the continuation of this line of experimentation, the present report summarizes some of the more prominent features previously considered and outlines the work to be undertaken. The points for special consideration are the growth of the pollen tube, a revision of the list of species supposed to show immediate effects of pollen, the stimulating action of pollen, and the possibility of superfœtation.

The laws regulating the sexes of flowers, T. MEEHAN (*Pennsylvania Dept. Agr. Rpt. 1898, pt. 1, pp. 536–548, figs. 4*).—The author maintains that in plants the question of male or female is wholly a question of nutrition.

Leaves and their uses, J. HOOPES (*Pennsylvania Dept. Agr. Rpt. 1898, pt. 1, pp. 677–694, figs. 4*).—The structure and function of leaves are described in a somewhat popular manner.

The plant food in the leaves of the sycamore and its transportation with the growth and the dying of the leaves, G. M. TUCKER and B. TOLLENS (*Ber. Deut. Chem. Gesell., 32 (1899), p. 2575; abs. in Chem. Ztg., 23 (1899), No. 90, Repert., p. 324*).

Photosynthesis in the evergreen leaves during the winter months, K. MIYABE (*Bot. Centbl., 80 (1899), No. 5, p. 172*).—The starch content of leaves fell from November to the end of January. The starch began to accumulate again in February.

Transpiration of evergreen trees during winter, S. KUSANO (*Bot. Centbl., 80 (1899), No. 5, p. 171*).

On the transmission of growth characteristics through selected seed, CLAUSEN (*Jour. Landw., 47 (1899), No. 4, pp. 391–430*).

On the growth of bamboo shoots, K. SHIBATA (*Bot. Centbl., 80 (1899), No. 5, pp. 169, 170*).

The grafting of monocotyledons (*Gard. Chron., 3. ser., 26 (1899), No. 674, p. 398*).—Success is claimed in grafting several species of the above.

Concerning the grafting of monocotyledons, L. DANIEL (*Compt. Rend. Acad. Sci. Paris, 129 (1899), No. 17, pp. 654–656*).—A note is given of the successful grafting and forming of a union in a number of experiments with monocotyledonous plants.

Concerning the existence of Penicillium glaucum in solutions of various organic salts, A. YASUDA (*Bot. Mag. [Tokyo], 13 (1899), No. 152, pp. 309–316*).

Additions to the knowledge of endotropic mycorrhiza, S. BERNÁTSKY (*Termeszet. Fuzetek, 1899, p. 88, pls. 2; abs. in Centbl. Bakt. u. Par., 2. Abt., 5 (1899), No. 16–17, p. 603*)

The so-called invisible injury by smoke and fumes, P. SORAUER and E. RAMANN (*Bot. Centbl., 80 (1899), Nos. 2–3, pp. 50–56; 4, pp. 106–116; 5, pp. 156–168; 6, pp. 205–216; 7, pp. 251–262*).

The behavior of algæ and fungi to certain chemicals, N. ONO (*Bot. Centbl., 80 (1899), No. 5, pp. 170, 171*).

On the toxic effect of deleterious agents on the germination and development of certain filamentous fungi, J. F. CLARK (*Bot. Gaz., 28 (1899), No. 5, pp. 289–327, dgms. 8*).—A report is given on the effect of a large number of deleterious agents, as shown on the germination and growth of a number of fungi, among them, *Aspergillus flavus*, *Sterigmatocystis nigra*, *Œdocephalum albidum*, and *Penicillium glaucum*.

Plant swellings, P. SORAUER (*Ber. Deut. Bot. Gesell., 17 (1899), No. 10, pp 456–460, fig. 1*).—Accounts are given of a number of plants showing excrescent growths which are attributed to a disturbance of the equilibrium between the functions of the plant.

On the histological modification produced by the action of Phytoptus, M. MOLLIARD (*Compt. Rend. Acad. Sci. Paris, 129 (1899), No. 21, pp. 841–844*).—Notes are given on the histological changes which are brought about in stems by the attacks of various species of Phytoptus, as shown from the structure of the galls.

Experimental investigations on the dwarfing of plants, P. GAUCHERY (*Ann. Sci. Nat. Bot., 8. ser., 9 (1899), Nos. 1, pp. 61–64; 2–4, pp. 65–156, pls. 4, figs. 32*).—A large number of experiments on dwarfing plants are described and the effects, as shown in the morphology and anatomy of the different plant members, are stated.

Is there a solution to the nitrogen problem? H. W. CONN (*Pennsylvania Dept. Agr. Rpt. 1898, pt. 1, pp. 717–734, figs. 4*).—After reviewing tho nitrogen requirements of plants, the author describes nitrifying and denitrifying bacteria and their methods of action. The fixation of nitrogen by the bacteria in the tubercles occurring on the roots of leguminous plants is described at some length, and the value of commercial products of soil bacteria commented upon.

A new register for studies in plant physiology, J. BARANETSKY (*Ber. Deut. Bot. Gesell., 17 (1899), No. 6, pp. 190–194, pl. 1*).—Describes an electric apparatus for registering growth and other phenomena of plants.

METEOROLOGY.

Meteorological report, N. HELME (*Rhode Island Sta. Rpt. 1898, pp. 212–229*).—This includes general notes on the weather during 1898, and a tabulated record of observations at Kingston on temperature, precipitation, cloudiness, and prevailing winds during each month of 1898, with a summary for the years 1890 to 1898 inclusive. The summary for 1898 is as follows:

Temperature (degrees F.).—Maximum, 95, July 3; minimum, —4, December 14; mean, 48.8; highest monthly mean, 71, August; lowest monthly mean, 27.9, January; highest daily mean, 80, September 1; lowest daily mean, 6, February 2. *Precipitation* (inches).—Total (rain and melted snow), 72.21; greatest monthly, 12.05, October; least monthly, 0.77, June; greatest in 24 consecutive hours, 5.5, July 13; snow fall—total, 59.75; greatest monthly, 20, November; least monthly, 1.75, December. *Weather.*—Number of clear days, 110; number of fair days, 114; number of cloudy days, 141; number of days on which there was precipitation of 0.01 in. or more, 131. *Prevailing wind,* west and southwest.

Meteorological observations at the experiment station of Kagok, Java, during ten years, 1889-1898, H. C. PRINSEN-GEERLIGS (*Meded. Proefstat. Suikerriet, West Java, No. 40, pp. 43, chart 1*).—This includes monthly and yearly summaries of observations on temperature, humidity of the air, soil temperatures (at depths of from 30 to 120 cm.), atmospheric pressure, cloudiness, wind movement, rainfall, number of cloudy days, evaporation, and storms.

During 1898 the hours of sunshine were also recorded. The rainfall for the 10 years, calculated to 5-day periods, is shown in a table and in a diagram.

The temperature is shown to be extremely uniform, the mean for 10 years being 26.4° C. The mean relative humidity of the air for the same period was 80; atmospheric pressure (at 0° C.), 755.4 mm.; rainfall, 2086.5 mm.; rainy days, 170; evaporation in 24 hours, 1.1 mm.; sunshine, 55 per cent of the possible.

Weather influences on farm and garden crops, E. MAWLEY (*Jour. Roy. Agr. Soc. England, 3. ser., 10 (1899), pt. 4, pp. 720–745, figs. 6*).—This is the annual address of the president of the Royal

Meteorological Society.[1] It gives a brief sketch of the climate of the British Isles; discusses the relation of temperature, frosts, rain, droughts, snow, sunshine, and wind to the growth of crops; and suggests various means of meeting adverse weather conditions. Meteorological data covering long periods are given in tables, charts, and diagrams.

The climate of Great Britain is shown to be characterized by frequent changes and the absence of extremes. From a table prepared by Sir Henry Gilbert,[2] giving the excess of daily temperature above 42° F. (5.55° C.) during the growing periods for 18 years, it is shown that the average amount of accumulated heat required to grow and ripen wheat at Rothamsted was 1896° F. The difference between the greatest and the least amount required was about 300° F. "This appears to be a very large range indeed, and shows that such calculations can only be regarded as rough approximations, at all events as far as the leading cereal crop in this country is concerned."

Meteorological observations (*Maine Sta. Rpt. 1898, pp. 230, 231*).—This is a monthly summary of observations at Orono during 1898 on atmospheric pressure, temperature, precipitation, cloudiness, and wind movement. The mean temperature for the year was 43.8 F. (mean for 30 years 42.3°), mean pressure 29.84 in., precipitation 49.82 in. (mean for 30 years 45.37), and number of cloudy days 138.

Meteorological chart of the Great Lakes—summary for the season of 1899, A. J. HENRY and N. B. CONGER (*U. S. Dept. Agr., Weather Bureau, Meteorological Chart of Great Lakes, 2 (1899), No. 9, pp. 28, charts 12*).—This is a summary of observations in the lake region during 1899 on storms, atmospheric precipitation, fog, ice, evaporation, and wrecks and casualties.

Snowfall and water supply of the Rocky Mountains, H. A. CRAFTS (*Sci. Amer., 82 (1900), No. 9, p. 133, fig. 1*).—A brief discussion relating especially to the head waters of the Big Laramie and Cache la Poudre rivers.

SOILS—FERTILIZERS.

The soils of the Pecos Valley, New Mexico, T. H. MEANS and F. D. GARDNER (*U. S. Dept. Agr., Division of Soils Circ. 3, pp. 7*).—This is a preliminary report on observations and investigations during 1899 in the irrigated districts around Carlsbad, Roswell, and Hagerman, in New Mexico, and Barstow, Tex., the object of which was "to map the soils of the irrigated districts of this region with particular reference to the extent of and damage from alkali and seepage waters, and to investigate methods for the prevention of further damage, and for the reclamation of lands already abandoned from these causes." The climate, drainage area, irrigation systems, and soils of the region are briefly discussed. The rise of the water table due to excessive or careless irrigation, and the accumulation of alkali due to the same causes and to rapid evaporation in the reservoirs and in the soil, constitute serious menaces to the agriculture of the region. Drainage is generally recommended, except for the soils underlaid by gypsum, on which it is believed it would prove too expensive, on account of their great capillary powers and rapid evaporation.

---

[1] Quart. Jour. Roy. Met. Soc. [London], 24 (1899).

[2] See also Arch. Sci. Phys. et Nat., 3. ser., 16 (1886), p. 421 (Rothamsted Memoirs, vol. 6).

The locust as a fertilizer, J. HÜNCKEL D'HERCULAIS (*La langosta como abono. Min. Agr. Argentine Republic, 1899, pp. 12*).—Chemical analyses and field experiments are reported. According to the analyses of Müntz and Girard, the locust has the following composition:

Fertilizer constituents in locusts.

	Nitrogen.	Phosphoric acid.	Potash.
	Per cent.	*Per cent.*	*Per cent.*
Fresh locusts	3.15	0.60	0.28
Dry locusts	11.50	2.18	1.02
Dry and fat-free locusts	14.00	2.50	1.60

In the pomace obtained by treating the locusts with superheated steam and alkali to remove the fat, there were found 11 to 12 per cent of nitrogen, 1 to 2 per cent of phosphoric acid, and about 0.5 per cent of potash. Analyses with reference to the food constituents of the locust are also reported. In plat experiments the locusts were used at rates of 400 to 600 kg. per hectare, alone or mixed with other materials, in comparison with other fertilizers. When used alone they were not very effective, apparently on account of the large amount of fat which they contain. The fertilizing effect was very greatly increased by the addition of superphosphate. The author suggests that treatment to remove the fat would not only increase the effectiveness of the material, but also prevent the offensive decomposition which takes place when the untreated material is applied to the soil.

Box experiments with phosphoric acid from different sources, L. H. MERRILL (*Maine Sta. Rpt. 1898, pp. 64–74, pls. 7, dgms. 2*).—This is a summary of all the results thus far obtained in these experiments, including those previously published (E. S. R., 9, p. 436).

The plants which have been experimented with include 7 orders: Peas, horse beans, clover, and alfalfa (Leguminosæ); turnips, ruta-bagas, cauliflower, and kohl-rabi (Cruciferæ); barley, corn, oats, and timothy (Gramineæ); tomatoes and potatoes (Solanaceæ); carrots and parsnips (Umbelliferæ); buckwheat (Polygonaceæ); sunflowers (Compositæ).

The results are briefly summarized as follows:

"(1) Plants differ in their ability to feed upon crude phosphates.

"(2) Turnips, ruta-bagas, cauliflowers, and kohl-rabi gave nearly as good returns with the Florida rock as with the acid rock.

"(3) In every other case the good effect of the acid rock was very marked.

"(4) In most cases the crude Florida rock yielded better returns than the Redonda.

"(5) Barley, corn, and oats seem to require an acid phosphate.

"(6) When early maturity is desired, the acid rock can profitably be used.

"(7) The largely increased production obtained by the use of the acid rock will often determine the success of the crop.

"(8) The solubility of a phosphate in ammonium citrate is not always the correct measure of its actual value to the plant."

Upon the possibility of drawing erroneous conclusions from plant soil tests designed as guides to the economical manurial treatment of soils, and to serve as a basis for the development of reliable chemical methods for ascertaining their requirements, H. J. WHEELER and J. A. TILLINGHAST (*Rhode Island Sta. Rpt. 1898, pp. 122-132, pls. 5*).—This article briefly reviews the history of experiments at the station on this subject which were begun in 1890 (E. S. R., 10, p. 937), bringing the account up to the close of the year 1898.[1] The method followed in 1898 was practically the same as that pursued in previous years. The conclusions reached from the 9 years' experiments are briefly summarized as follows:

"(1) Before liming, phosphoric acid was more needed than nitrogen or potash.

"(2) After liming, the soil stood less in need of phosphoric acid than of potash or nitrogen.

"(3) Large quantities of phosphoric acid which had heretofore been largely unassimilable were made of use to plants by treating the soil with lime.

"(4) The above points should be taken into account, and lime applied to all the plats of a soil test when experimenting with such soils as are acid or in other respects stand in need of liming.

"(5) In attempting to secure chemical methods for showing the manurial requirements of soils, as based upon soil tests with plants, erroneous conclusions may be drawn as to their relative reliability if the other ingredients of which the soil stands in need are not applied to all of the plats before the tests as to the relative deficiency of potash, phosphoric acid, and nitrogen are begun.

"(6) One plant may not necessarily answer the question satisfactorily as to the manurial requirements of all other plants upon the same soil.

"(7) At least before liming, maize answers the question satisfactorily as to deficiencies of phosphoric acid, not only for the other cereals, but also for millet, beets, and many other crops.

"(8) Soil tests, designed to show what manurial substances will be yielded to plants in the least quantity for a series of years, must be continued for several seasons before final conclusions can safely be drawn."

On the effectiveness of nitrate of potash as compared with like amounts of nitrogen and potash in form of muriate of potash and nitrate of soda, H. J. WHEELER and J. A. TILLINGHAST (*Rhode Island Sta. Rpt. 1898, pp. 133-136*).—These experiments were begun in 1895 (E. S. R., 10, p. 938). The experiments were conducted on the same plan in 1898 as in previous years, the crops grown being grass and mangel-wurzels.

"In every case, both with grass and mangel-wurzels, a greater total yield was obtained where nitrate of soda and muriate of potash were employed than in connection with like amounts of potash and nitrogen in form of nitrate of potash.

"In view of the perfect harmony, in this particular, of all the results, it seems probable that some special value must be ascribed to the soda or chlorin, or, possibly, to both. . . . .

---

[1] An abstract of this paper will be found in U. S. Dept. Agr., Office of Experiment Stations Bul. 65, p. 113 (E. S. R., 10, p. 711).

"A continuation of this experiment for a few years more ought to furnish some positive information as to the worthlessness or possible value of the soda and chlorin of nitrate of soda and muriate of potash, which have heretofore been quite generally looked upon as ingredients of little or no agricultural value."

The fifth year's observations on the substitution of soda for and its value in connection with potash, H. J. WHEELER and J. A. TILLINGHAST (*Rhode Island Sta. Rpt. 1898, pp. 137–143, pls. 7*).—This is an account of a continuation during 1898 of experiments begun in 1894 (E. S. R., 10, p. 938). The plan followed in 1898 was the same as in previous experiments. The crops grown were oats and millet.

"The results for the year 1898 show the marked inferiority of soda when used without potash as compared with potash when used without soda, corroborating fully in this respect the experience of previous years.

"When the potash supply was reduced to a quarter ration the soda proved quite effective. Where the potash supply was equivalent to half and three-quarter rations the soda seemed to be far less effective than in 1897."

The sixth year's observations upon the growth of plants upon an acid upland soil, limed and unlimed, H. J. WHEELER and J. A. TILLINGHAST (*Rhode Island Sta. Rpt. 1898, pp. 144–170, pls. 4*).—The same methods were pursued in these experiments in 1898 as in previous years (E. S. R., 10, p. 939), except that in 1898, as in 1897, the quantities of nitrogen applied were one-third as great as in former years (85.5 lbs. of sulphate of ammonia and 116.25 lbs. of nitrate of soda per acre), and muriate of potash and dissolved boneblack were applied at rates of 300 and 800 lbs., respectively. No lime has been applied since 1894. A number of new crops were introduced into the experiments in 1898, bringing the total number of varieties experimented with up to about 120. The new crops employed in 1898 included white mustard, parsley, Swiss chard, chicory, leeks, garlic, endive, dwarf broom corn, aster, sweet peas, and poppy. Tables show the yields of the various crops grown and give a record of measurements in the spring and autumn of 1898 of the diameters of various fruit and forest trees experimented with.

"Strawberries appear to have been helped by lime on very acid soil. . . .

"Asparagus has been wonderfully helped by lime. The superiority of nitrate of soda, as compared with sulphate of ammonia, for this plant was also most striking, affording a strong contrast in this particular with blackberries.

"Rhubarb was apparently helped by lime, though in a small degree as compared with asparagus. Nitrate of soda also proved slightly more effective than sulphate of ammonia as a source of nitrogen.

"White mustard showed moderate benefit from liming, and indicated the superiority of nitrate of soda as a form of nitrogen.

"Parsley showed little, if any, advantage from the use of lime in connection with nitrate of soda, though on the unlimed sulphate of ammonia plat the results were extremely poor as compared with those where lime was applied. Comparing the two limed plats, but little difference in the two forms of nitrogen was noticeable.

"Swiss chard, like beets, to which it is closely related, was wonderfully helped by lime, and gave far better results with nitrate of soda than with sulphate of ammonia.

"Chicory was not helped, but, on the contrary, apparently injured by lime upon the nitrate of soda plats. Where sulphate of ammonia has been used continuously lime was, however, useful. Sulphate of ammonia gave better results than nitrate of soda on the limed plats.

"Leeks were helped by lime in a most striking degree, even upon the nitrate of soda plats. For this crop the superiority of nitrate of soda as compared with sulphate of ammonia, even upon the limed plats, was also marked.

"Endive plants were materially helped by lime, though in a less degree than asparagus or Swiss chard. These plants showed marked ability to withstand the conditions upon the unlimed sulphate of ammonia plat, where leeks and Swiss chard failed utterly. Nitrate of soda gave better results than sulphate of ammonia upon the limed plats, though the difference was less striking than in the case of many other plants.

"Carrots have indicated, usually, varying benefit from liming upon quite acid soil, but upon a neutral or alkaline one heavy applications might exert injury. . . .

"Mangel-wurzels fully corroborated the experience of previous years, showing striking benefit from the use of lime and great superiority of nitrate of soda over sulphate of ammonia when nitrogen in these forms is employed in like amounts and under identical conditions.

"Watermelons give indication that the great injury otherwise resulting from liming can probably be avoided if the melons are introduced into the rotation three or more years after the lime is applied. This season nitrate of soda proved, when used without lime, but slightly better than sulphate of ammonia, though on the limed plats the nitrate form of nitrogen was much superior.

"Muskmelons have fully agreed with the tests in former years, indicating great benefit from liming and the superiority of nitrogen in the form of nitrate of soda.

"Dwarf broom corn was helped moderately by liming, and on the limed plats the results were identical in the case of both forms of nitrogen.

"Comet aster ('The Bride'), though it was helped by lime, even in connection with nitrate of soda, showed, nevertheless, wonderful ability to withstand the acid condition existing on the unlimed sulphate of ammonia plat where so many other kinds of plants entirely failed. But little difference was noticed between the action of the two forms of nitrogen.

"Sweet peas showed marked advantage from the employment of lime, as shown by the increased weight of vines, and especially by the great increase of blossoms. Many more blossoms and heavier vines were produced by nitrate of soda than by sulphate of ammonia upon the limed plats.

"Poppies seemed to be wonderfully helped by lime, as indicated by the number of blossoms and by the total weight of the plants. Nitrate of soda proved far superior to sulphate of ammonia as a source of nitrogen for this plant. . . .

"The indications thus far afforded go to show that lime has proved especially beneficial to the American linden, elm, and to quince bushes. It appears probable that certain trees, possibly including the white birch and Norway spruce, may be injured by liming, even on very acid soil.

"This season's results with Snyder blackberries are especially interesting, for the reason that in connection with the nitrate of soda plats lime seems to have caused injury, and, furthermore, on account of the superior action of sulphate of ammonia compared with nitrate of soda as a source of nitrogen."

Water conservation in soils, S. M. WOODBRIDGE (*Forester, 5 (1899), No. 8, pp. 181, 182*).—The author gives a popular account of water conservation and points out the necessity of forest cover on mountain sides for the maintenance of stream flow.

Analyses of soils of São Paulo, Brazil, G. D'UTRA (*Bol. Inst. Agr. São Paulo, 10 (1899), No. 6, pp. 375–396*).—Chemical analyses of several samples of soils from different parts of São Paulo are reported, with suggestions as to the fertilizers suitable to each.

The decomposition of organic substances and the forms of humus in their relations with agriculture, E. WOLLNY (*Ann. Sci. Agron., 1898, II, p. 339; 1899, I, No. 2, pp. 208–286, figs. 43; II, Nos. 1, pp. 1–116, figs. 2; 2, pp. 260–299, figs. 3; 3, pp. 362–439; 1900, I, No. 1, pp. 1–29*).—See E. S. R., 8, p. 879.

A contribution to the knowledge of soil bacteria, R. KOLKWITZ (*Centbl. Bakt. u. Par., 2. Abt., 5 (1899), No. 20, pp. 670–678, pl. 1*).—Studies are given on the Alinit bacillus (*B. ellenbachensis*) and other soil organisms.

Green manures, TRABUT (*Gouv. Gen. Algeria, Serv. Bot., Sta. Exp. Rouiba Bul. 20, 1899, pp. 24, figs. 15*).—A brief discussion of the principles of green manuring and of the value for this purpose of various plants tested at the station of Rouïba, Algeria. The plants discussed include 4 species of lupines, fenugreek, beans, vetches, 4 species of Lathyrus, melilotus, lentils, serradella, sulla and other species of Hedysarum, galega, 2 species of Mucuna, including velvet bean (*Mucuna utilis*), cow peas, soy beans, and *Madia sativa*.

The fertilizing value of lupines at different stages of growth, HEINRICH (*Fühling's Landw. Ztg., 49 (1900), Nos. 2, pp. 61–67; 3, pp. 90–94*).—Plat and pot experiments are reported in detail, which lead to the conclusion that the best results as green manure will be obtained by turning under the lupines when they begin to ripen and less than half of their leaves have become yellow, because at this stage the plant has reached the limit of production.

History and present status of Peruvian guano, MAIZIÈRES (*L'Engrais, 15 (1900), No. 4, pp. 83–85*).—The history of the exploitation of the Peruvian deposits of guano is briefly reviewed and statistics of their present extent and exportation are given.

Fertilizer inspection in 1898, C. D. WOODS (*Maine Sta. Rpt. 1898, pp. 38–47*).—The requirements of the State fertilizer law are briefly explained, and the composition of samples of fertilizers collected by the station is compared with that of samples furnished by the manufacturers and with the guaranteed analyses for 1898 and for the three years 1896–1898. See also Bulletins 43 and 45 of the station (E. S. R., 10, pp. 387, 734).

Report of analyses of commercial fertilizers for the spring of 1899, L. L. VAN SLYKE (*New York State Sta. Bul. 160, pp. 63–151*).—The results of analyses of 646 different brands of fertilizers are reported. Of these 482 were complete fertilizers in which the nitrogen varied from 0.37 to 8.5 per cent, averaging 2.01 per cent. The available phosphoric acid varied from 1.2 to 15.12 per cent, averaging 8.76 per cent. The potash varied from 0.43 to 12.95 per cent, averaging 4.86 per cent. The average amounts of nitrogen, available phosphoric acid, and potash exceeded the guaranteed average by 0.15, 0.98, and 0.3 per cent, respectively. The bulletin also gives the text of the State fertilizer law as amended in 1899. The amended law requires a license fee of $20 for each brand.

Analyses of commercial fertilizers, T. J. EDGE and W. FREAR (*Pennsylvania Dept. Agr. Bul. 44, pp. 62*).—Includes text of the State fertilizer law, notes on the valuation of fertilizers, and tabulated analyses and valuations of 945 samples examined during 1898. This is reprinted in the Pennsylvania Department of Agriculture Report for 1898, pt. 1, p. 805.

Miscellaneous analyses, H. J. WHEELER (*Rhode Island Sta. Rpt. 1898, pp. 117–121*).—Analyses (mainly fertilizing constituents) are reported of cotton-seed meal, refuse from indigo dye vats, Belgian phosphate, "floats" (finely ground mineral phosphate), steamed bone, dissolved bone, superphosphate, tankage, dried blood, nitrate of soda, sulphate of ammonia, nitrate of potash, potassium carbonate, muriate of potash, sodium carbonate, common salt, and burnt lime.

The production and consumption of phosphatic slag in Europe, MAIZIÈRES (*L'Engrais, 15 (1900), No. 6, pp. 132–134*).—The total production in Europe is stated to be 1,416,000 tons (metric), the greatest producer being Germany, 786,000 tons. The consumption in the countries manufacturing the product is placed at 1,208,000 tons; the exports, mainly to Italy, Russia, Holland, Switzerland, Norway and Sweden, Australia, and other countries, at 208,000 tons.

The injurious effect of perchlorate in nitrate of soda, J. STOKLASA (*Bl. Zuckerrübenbau, 7 (1900), No. 2, pp. 17–28; Böhm. Ztschr. Zuckerind., 24 (1899), p. 131*).—According to the author's experiments the limit of endurance of rye for perchlorate is 1 per cent, for oats 1.5 per cent, and for wheat, barley, and beets 2 per cent. Beets are especially resistant to perchlorate. Of 200 samples of nitrate of soda examined, 132 contained less than 1 per cent of potassium perchlorate; 40 contained 1 to 1.5 per cent; 20, 1.5 to 2 per cent; 6, 2 to 3 per cent, and 2, 3 to 7 per cent.

A further study of the lime requirement of Rhode Island soils, H. J. WHEELER and G. E. ADAMS (*Rhode Island Sta. Rpt. 1898, pp. 171–179, pls. 4*).—This is an account of cooperative experiments in 8 different localities in the State during 1898 in continuation of work of previous years (E. S. R., 10, p. 938). "The experiments of this season fully confirm the opinion that a need of lime is much more universal in Rhode Island than has been generally supposed."

FIELD CROPS.

A chemical study of the sea-island cotton plant, F. S. SHIVER (*South Carolina Sta. Bul. 47, pp. 102, fig. 1*).—Preliminary to the chemical work of this bulletin, the author gives a general discussion of the origin of sea-island cotton, its history in South Carolina, production, uses, culture, character, and appearance; describes the character of sea-island cotton soils, and the method of preparing lint, and gives data showing the cost of production and profit in growing per acre.

The analytical data show the food and fertilizing constituents of the whole plant and of each individual part. The finest and coarsest samples of the sea-island cotton crops of 1896 and 1898 were used in the analyses. The data obtained are compared with similar data obtained in the analysis of upland cotton. The following table shows the average analysis of different parts of the 1896 and 1898 crops of finest and coarsest sea-island cotton with reference to fertilizing constituents:

Average analysis of parts of the sea-island cotton plant.

	Lint.		Seed.		Bolls.		Leaves.		Stems.		Roots.	
	Ash.	Air-dry.	Ash.	Air-dry.	Ash.	Air-dry.	Ash.	Air-dry.	Ash.	Air-dry.	Ash.	Air-dry.
Finest:	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
Moisture	......	5.69	......	8.36	......	11.54	......	12.03	......	7.99	......	6.48
Crude ash	......	1.66	......	4.48	......	7.52	......	11.58	......	4.48	......	3.43
Nitrogen	......	40	......	3.36	......	1.54	......	2.10	......	.74	......	.57
Phosphoric acid	8.99	.149	35.72	1.601	10.75	.809	9.32	1.079	10.56	.173	9.91	.34
Potash	37.47	.622	35.15	1.575	41.20	3.098	19.63	2.272	34.07	1.526	29.54	1.014
Lime	13.07	.217	7.76	.347	13.03	.980	30.10	3.484	20.80	.932	15.49	.531
Magnesia	8.29	.147	14.54	.652	6.19	.465	5.36	.620	6.15	.276	6.76	.212
Sulphuric acid	5.92	.098	3.78	.170	7.30	.549	8.10	.938	3.80	.170	2.51	.086
Insoluble matter	9.71	.161	.67	.030	3.34	.251	5.93	.686	1.62	.073	3.05	.125
Coarsest:												
Moisture	......	5.63	......	7.75	......	11.42	......	12.57	......	7.12	......	7.58
Crude ash	......	1.65	......	4.58	......	7.17	......	10.74	......	3.32	......	3.74
Nitrogen	......	40	......	3.35	......	1.41	......	2.56	......	.72	......	.61
Phosphoric acid	8.52	.139	36.11	1.652	10.15	.727	8.10	.870	8.60	.285	8.31	.311
Potash	37.32	.616	36.10	1.652	41.08	2.944	16.97	1.822	28.50	.945	22.10	.827
Lime	9.82	.162	6.45	.295	13.54	.970	31.52	3.384	23.69	.786	15.87	.594
Magnesia	7.08	.126	14.46	.661	6.62	.475	6.64	.713	7.13	.237	8.11	.303
Sulphuric acid	5.93	.098	3.40	.156	6.42	.460	6.07	.651	3.01	.099	2.08	.078
Insoluble matter	8.49	.141	.95	.043	3.00	.215	5.61	.602	1.90	.063	13.46	.504

Actual and calculated analyses were made of the whole plant. The following table shows these data:

Actual and calculated analyses of the whole cotton plant.

	Finest variety.						Coarsest variety.					
	Actual analysis.			Calculated analysis.			Actual analysis.			Calculated analysis.		
	Ash.	Water free.	Air-dry.	Ash.	Water-free.	Air-dry.	Ash.	Water-free.	Air-dry.	Ash.	Water-free.	Air-dry.
	P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
Moisture	......	......	7.420	......	......	9.120	......	......	5.98	......	......	8.50
Crude ash	......	6.520	6.040	......	6.90	6.270	......	5.850	5.50	......	5.90	5 40
Nitrogen	......	1.340	1.240	......	1.52	1.380	......	1.460	1.37	......	1.52	1.39
Phosphoric acid	14.48	.944	.874	11.81	.815	.741	10.56	.618	.581	11 22	.662	.606
Potash	34.22	2.231	2.065	28.59	1.978	1.793	32.99	1.930	1.815	25.66	1.514	1.385
Lime	20.74	1.352	1.252	22.22	1.588	1.398	14 31	.837	.787	19.56	1.154	1.056
Magnesia	5.43	.354	.328	6 45	.445	.404	7.21	.422	.397	7.34	.438	.396
Sulphuric acid	5.63	.367	.341	6.10	.421	.383	5.08	.297	.279	4.27	.252	.231

The percentages of the parts of the sea-island cotton plant were determined. The comparison of this data with similar data for upland cotton is shown in the following table:

Percentages of parts of sea-island and upland cottons (water-free material).

Parts determined.	Sea-island cotton.				Upland cotton.	
	Finest.		Coarsest.			
	Weight.	Per cent.	Weight.	Per cent.	Weight.	Per cent.
	Grams.		*Grams.*		*Grams.*	
Lint	12.08	4.10	24 15	6.60	17.45	10.56
Seed	29 99	10.17	49.40	13.49	38 07	23.03
Bolls	36.32	12 32	45.32	12 38	23.49	14.21
Leaves	66.40	22.52	50 98	13.93	33.48	20.25
Stems	110 58	37.50	144.64	39 50	38 26	23.15
Roots	39.47	13.39	51.61	14 10	14 55	8.80
Total	294.84	100.00	366.10	100.00	165.30	100.00

On the basis of the proportionate parts of the plant, it is calculated that a crop of the finest sea-island cotton, yielding 200 lbs. of lint per acre would produce 507 lbs. of seed, 620 lbs. of bolls, 1,137 lbs. of leaves, 1,834 lbs. of stems, and 640 lbs. of roots, or a total crop of 4,938 lbs. (air-dry). In round numbers, this crop would remove from the soil 68.5 lbs. of nitrogen, 36.6 lbs. of phosphoric acid, and 89.4 lbs. of potash. The number of plants per acre for this crop is estimated at 7,079. By the same method of calculation, a crop of the coarsest variety of sea-island cotton, yielding 200 lbs. of lint per acre, would produce 411 lbs. of seed, 384 lbs. of bolls, 439 lbs. of leaves, 1,192 lbs. of stems, and 427 lbs. of roots, or a total crop of 3,053 lbs., which is nearly a ton less than the total yield of an acre of the finest sea-island cotton. The amount of fertilizing constituents removed by this crop is calculated, in round numbers, at 42 lbs. of nitrogen, 18 lbs. of phosphoric acid, and 43 lbs. of potash. The number of plants per acre is estimated at 3,555.

The author averages the results of these 2 crops and concludes that an average crop of sea-island cotton would have a total weight of 3,683 lbs. and contain 4,734 plants to the acre. This crop would contain in round numbers 51 lbs. of nitrogen, 58 lbs. of potash, and 24 lbs. of phosphoric acid.

In the light of this data the author critically discusses present methods followed by many planters in fertilizing cotton, and suggests methods for improving the fertilizer formulas. The whole matter is summarized in tabular form. The data show that in practice on an average 60 lbs. of phosphoric acid, 45 lbs. of nitrogen, and 49 lbs. of potash are applied per acre by the best planters. A fertilizer composed of 4 per cent available phosphoric acid, 7 per cent nitrogen, and 8 per cent potash, applied at the rate of 750 lbs. per acre, would just about restore to the soil the amount of fertilizing elements removed by an average crop of sea-island cotton yielding 200 lbs. of lint per acre. The use of marsh mud as a fertilizer for cotton is especially noted, and analyses given of 2 samples.

The exhaustive effect of growing sea-island cotton when both lint and seed are entirely removed from the land is considered. The removal of the lint alone is an item of minor importance, and even when the seed is also removed, the amount of fertilizing constituents taken from the soil is less than half that removed by crops of 30 bu. of wheat or 20 bu. of corn. There is a close agreement between the amount of plant food removed by a crop of sea-island cotton and that removed by upland cotton, with the difference slightly in favor of the sea-island cotton.

The analyses with reference to food constituents of lint, seed, bolls, leaves, stems, and refuse of the 1896 and 1898 crops of coarsest and finest sea-island cotton is shown in the following table:

Average analyses of the parts of the plant of the finest and coarsest varieties of sea-island cotton.

Determined	Lint		Seed		Bolls		Leaves		Stems		Roots.	
	Water free	Air dry	Water free	Air dry.	Water free	Air-dry.	Water-free	Air-dry.	Water-free.	Air-dry.	Water-free.	Air-dry.
	P. ct	P. ct	P. ct	P. ct	P. ct.	P. ct.	P. ct.	P. ct	P. ct.	P. ct.	P. ct	P. ct.
Finest												
Moisture		5.69	......	8.36	.....	11.54	.....	12.05	......	7.99	......	6.73
Crude protein	2.62	2.47	22.93	21.01	10.85	9.60	14.93	13.18	4.99	4.59	3.88	3.57
Crude fat	1.23	1.16	20.49	18.78	3.06	2.71	4.96	4.36	1.70	1.56	1.82	1.70
Crude fiber	86.42	81.50	16.94	15.52	27.64	24.45	14.39	12.66	52.31	48.13	51.66	48.18
Crude ash .. .	1.76	1.66	4.89	4.48	8.50	7.52	13.17	11.58	4.87	4.48	3.68	3.43
Nitrogen free extract	7.97	7.52	34.75	31.85	49.95	44.18	52.55	46.22	36.13	33.25	39.01	36.39
Coarsest												
Moisture	..	5.63	...	7.75	......	11.42	......	12.57	......	7.12	....	7.58
Crude protein.......	2.65	2.50	22.67	20.91	9.96	8.82	18.30	16.00	4.84	4.50	4.09	3.78
Crude fat....	1.36	1.28	22.37	20.64	2.92	2.59	6.02	5.26	1.17	1.09	1.96	1.81
Crude fiber	85.46	80.65	16.38	15.11	29.10	25.78	12.07	10.55	52.70	48.95	50.92	47.06
Crude ash	1.80	1.70	4.96	4.58	8.09	7.17	12.28	10.74	3.57	3.32	4.05	3.74
Nitrogen-free extract	8.73	8.24	33.62	31.01	49.93	44.22	51.33	44.88	37.72	35.02	38.98	36.03

The food composition of the whole plant was determined by grinding together the different parts and incorporating the lint with the mixture.

The food constituents of the different parts of the plant are considered of little value unless ground and mixed with meal or grain or with some succulent food, as corn silage. Under such conditions the plant would compare favorably in feeding value with meadow hay.

In conclusion the analyses are compared with those of Jackson, Ure, and Wohltmann, and with the analyses of upland cotton by McBryde (E. S. R., 3, p. 537). The upland cotton has the larger stem and root development. The absolute amount of lint and seed produced on an acre is about the same in both cases, but the upland cotton requires a larger amount of fertilizer. The seed of the sea island cotton is much richer in fertilizing constituents, and is considered superior to upland cotton seed for feeding purposes, although somewhat poorer in fat and fiber.

Relative effects on cotton and corn of certain leguminous crops turned under entire and their stubble only turned under, R. L. BENNETT (*Arkansas Sta. Bul. 58, pp. 106, 107*).—Cowpeas, soy beans, and velvet beans were grown under uniform conditions and half of each plat cut and removed for hay. The entire plats were plowed under in the fall. Cotton was planted on the different plats the following spring. The largest yield of seed cotton per acre was obtained from the plat where the vines and stubble of velvet beans had been turned under. The yields were considerably reduced when the vines were cut for hay and the hay removed. In a similar experiment with corn the best yield was obtained on the plat where soy-bean vines and stubble had been turned under, followed by the plat on which cowpea vines had been turned under. Velvet beans were not used in the experiment with corn. The author notes that "the value of the hay cut from the 2 stubble plats was worth more than the increase of corn and cotton on plats where the vines were turned under for manure."

Winter pasturage, hay, and fertility afforded by hairy vetch, J. F. DUGGAR (*Alabama College Sta. Bul. 105, pp. 129-160*).—This bulletin gives in detail methods of growing, inoculating, and fertilizing hairy vetch (*Vicia villosa*), and considers its adaptability as winter pasturage and green-manure crop for the South. Earlier work with this plant at the station has been reported (E. S. R., 10, p. 837).

Hairy vetch is considered an especially valuable forage plant for the South, as its culture does not in any way interfere with the regular farm crops, and it is valuable either as pasturage, hay, or for use as a green-manure crop. Sown in September or October, alone or with oats, it furnishes pasturage during the following February, March, April, and May, and, if not grazed too late, it affords a cutting of hay from April 20 to May 10. Its growth during the winter months serves to prevent leaching of the soils, and adds greatly to the supply of soil nitrogen, Specific directions are given for securing the growth of the plant, on land where it has not been previously grown, by the aid of Nitragin, inoculations from old hairy vetch or English pea fields, and inoculation by replanting on the same land.

A special study was made at the station of the most suitable time for cutting hairy vetch for hay and for using as a green manure. The following table shows the yield and composition of the crop when cut at different dates for hay:

Yield and composition of hairy vetch cut at different dates.

Date.	Stage of growth.	Hay.	Composition.					
		Yield per acre.	Moisture.	Crude protein.	Carbohydrates.	Fat.	Crude fiber.	Ash.
		Lbs	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
Apr. 19	Just before blooming	3,117	20.72	23.45	26.25	2.22	20.24	[illegible].12
Apr. 26	5 per cent of blooms showing	3,705	22.83	18.97	29.06	2.11	20.44	[illegible].59
May 2	In full bloom	5,789	20.30	17.15	32.12	2.14	22.50	5.[illegible]9
May 9	Seed pods formed but not filled	5,463	22.48	18.71	29.50	2.35	19.92	7.04

"The percentage of protein (muscle formers) in vetch hay is higher than in other leguminous hays, as red clover and cowpea vines, which are usually taken as standards in this respect, and much higher than in corn blades or 'fodder.' Vetch hay contains 3 times as much of these 'muscle formers' as Johnson grass hay."

In order to determine the fertilizing value of hairy vetch at different stages of growth, samples of vines, stubble, and roots were taken at different dates and analyzed. The roots were taken to a depth of 6 in. and were attached to stubble 2 or 3 in. long. The data obtained are summarized in the following table:

Analyses of vines, roots, and stubble of hairy vetch at different stages of growth.

Date.	Stage of growth.	Air-dry material per acre.	Fertilizing materials.		
			Nitrogen.	Phosphoric acid.	Potash.
Apr 19	Just before bloom:	*Pounds.*	*Per cent.*	*Per cent.*	*Per cent.*
	Vines	3,117	3.75	0.81	2.18
	Roots and stubble	850	2.36	.49	1.23
Apr 26	5 per cent of blooms showing				
	Vines	3,705	3.03	.78	2.14
	Roots and stubble	870	2.03	.48	.88
May 2	In full bloom				
	Vines	5,789	2.75	.79	2.21
	Roots and stubble	1,054	1.97	.48	.88
May 9	Seed pods formed, but not filled:				
	Vines	5,463	2.99	.74	2.68
	Roots alone	346	2.19	.43	.96
	Stubble, fallen leaves, and blooms	1,061	2.07	.42	1.14

It is calculated that the nitrogen contained in the vines, stubble, and roots from an acre harvested when the plant was in full bloom, May 2, would be equivalent to the nitrogen contained in 2,571 lbs. of cotton-seed meal, and that one week later it would be equivalent to 2,896 lbs. of cotton-seed meal. The total nitrogen content of the crop increases with the stage of maturity. This suggests the advisability of postponing plowing-under the crop for green manure until as late in the life of the plant as practicable.

A brief account is given of experiments in growing corn on plats where either the entire growth of vetch, the stubble of vetch, or the entire growth of nearly matured rye or the stubble of rye, had been plowed under. "The yield of corn in 1898 was at least 50 per cent, and in some instances 100 per cent, greater on the plats where vetch or vetch stubble had been plowed in than on the plats where rye had grown."

There was but little difference in the yield of grain, whether the entire vetch plant or only the stubble and roots were plowed under. When silage corn was grown the yield per acre on the vetch stubble plat was 2.75 tons less than on the plat where vetch vines, stubble, and roots had been plowed under.

"This superior yield of silage corn resulting from plowing in the entire growth of vetch was more than offset by the 3,600 lbs. of hay per acre obtained from the vetch stubble plat. This contained a greater amount of dry matter of better quality than that in the 2.75 tons of silage corn."

Directions for sowing hairy vetch, fertilizing, reseeding, and adapting to ordinary rotations are considered in some detail, and mention made of the enemies of vetch and the possibility of the plant becoming a weed.

The water requirements of the oat plant under different conditions of soil moisture and of manuring, C. VON SEELHORST (*Jour. Landw., 47 (1899), No. 4, pp. 369–378*).—Experiments were made with oats to ascertain whether the quantity of water required to produce a given amount of dry matter is determined exclusively by the growth of the plant, or whether the composition of the fertilizers applied is also concerned in it. It was concluded from the experiments that in general the quantity of water required to produce a unit of dry matter decreases as the luxuriance of growth increases. It was also concluded that the water requirement is influenced by the relative amount of each fertilizer element supplied, and that too heavy an application of a single element, even though it results in little or no increase in yield, nevertheless increases the water requirement of the plant. The experiments appear to indicate that the composition of the soil exercises much influence on water requirement.

The practical value of these results, it is stated, lies in the demonstration of the fact that up to a certain point the more nearly complete the fertilizer applied, the more fully may the soil water be utilized; but if the water content of the soil is too low the concentration of the solutions in the soil, such as would follow a heavy application of fertilizer, have an injurious effect on growth.

Planting unshelled peanuts, R. L. BENNETT (*Arkansas Sta. Bul. 58, pp. 102, 103*).—A comparison was made of growing peanuts from shelled, unshelled, and broken seed. The unshelled peanuts were prepared by placing a small quantity of nuts in a sack and immersing in water for 12 hours to thoroughly wet the hulls, after which the sacks were buried in the earth below frost line. Peanuts were thus treated January 1, February 1, March 1, and April 1. They remained in the ground until April 23, when they were taken up and planted. On the same date plantings were made of shelled nuts, of dried unshelled nuts and of nuts with pods broken into two parts. The percentage growth of the different lots of seed is tabulated. The most perfect stand (95.1 per cent) was obtained from the nuts planted in broken pods. The shelled nuts stood second (94.8 per cent) and the unshelled nuts buried in the earth April 1, third (92.5 per cent). None of the unshelled pea nuts buried in the earth January 1 grew. The results seemed to indicate that when nuts have been thoroughly wet and kept moist for a short period they will produce a good stand. This saves the expense of shelling the peanuts by hand.

Trials of varieties of potatoes, J. A. TILLINGHAST and H. J. WHEELER (*Rhode Island Sta. Rpt. 1898, pp. 180–185*).—Eighteen varieties of field potatoes and 4 varieties of German salad potatoes were grown. Early Michigan gave the largest yield of tubers among the early varieties tested, 255.2 bu. per acre. The best total yield of all the varieties tested was made by the Prof. Maercker, 399.8 bu. per acre.

The German salad potatoes were compared in a cooking test with tubers of the New Queen variety for salad purposes. The German potatoes held their form well and "proved superior in every respect for salad purposes." Descriptive notes are given on 11 of the varieties tested.

Field experiments with fertilizers on tobacco; influence upon yield, W. FREAR (*Pennsylvania Dept. Agr. Rpt. 1898, pt. 1, pp. 662–676*).—A summary is given of the cooperative tobacco fertilizer experiments begun by the station in 1893 (E. S. R., 7, pp. 762, 947), and including the results in 1897. The general purpose of these experiments has been "(1) to compare stable manure with artificial fertilizers rich in humus-making ingredients; (2) to determine the influence of the kind of material used to supply the fertilizer elements upon the yield and quality of tobacco leaf, the quantities of nitrogen, potash, and phosphoric acid being the same in each artificial combination; and (3) to determine the need for soluble phosphates in addition to those present in the humus-making ingredients of the artificial fertilizers. Treatment as regards culture, curing, and sorting was the same throughout."

Each of the principal fertilizer formulas employed contained similar amounts of the 3 essential elements, viz, 95 lbs. of nitrogen and 155 lbs. each of potash and phosphoric acid per acre.

> "The experiments were conducted in Donegal (Marietta), (1893–1897), and at Rocky Spring (Lancaster), (1893–1895), in Lancaster County, and at Ulster (1895) and Wysox (1896–97), Bradford County. The Lancaster County stations were upon typical limestone-clay soil of that tobacco region, the soil being moderately supplied with humus and lime, rich in magnesia, iron, and alumina, and well supplied with potash, but rather deficient in nitrogen, and that at Donegal in phosphoric acid. The Wysox alluvium was sandy and contained nearly as much iron, lime, and phosphoric acid as the Rocky Spring soil, but less nitrogen, magnesia, and sulphuric acid."

The yields of tobacco obtained per acre with the different combinations and amounts of fertilizers in the various localities are tabulated for the different years. The author summarizes the results obtained as regards the yield of leaf as follows:

"With a single season excepted (Wysox, 1897), stable manure was surpassed, at all places and in all seasons, by artificial fertilizers rich in humus-making materials, such as cotton seed or linseed meal, their yield being from 3 to 15 per cent greater than by stable manure.

"Linseed meal, used only at Donegal, was never superior and sometimes inferior to the less expensive cotton-seed meal.

"Horn meal was quite inferior, at first, to cotton-seed meal; but as its residual effect accumulated and as it was aided by later moist seasons, the inferiority diminished.

"Wheat bran gave excellent results during the single season of its trial, but the conditions of test do not permit comparison with the other similar substances used in these experiments.

"The partial substitution of nitrate of soda for cotton-seed meal resulted in a larger yield only in the dry seasons on the clay soil; in other seasons, in a considerable diminution of crop, not to mention the inferiority shown in the field appearance of the leaf produced. At Ulster it caused an increase of yield.

"The similar substitution of sulphate of ammonia was productive of a very marked gain at Donegal, though this varied in different seasons. There was more variation on the alluvial soil, but the results were in general favorable to this substitution. At Donegal the average for the years 1894–1897, this treatment not having been started in 1893, shows an increase of 120 lbs. of leaf per acre as the result of this substitution.

"The double carbonate of magnesia and potash produced a plant of excellent quality, and the average yield was materially improved. The superior excellence of result was more notable in dry seasons than in moist, and was observed both on the clay soils and the alluvium. The most marked peculiarity of the crops produced by the mixture containing this ingredient was the uniformly fine quality of the leaf both in dry and wet seasons.

"The use of wood ashes was not a part of the original plan of the experiment. When used it was applied alone in large quantity to a plat that had in preceding years received stable manure only. The result was not favorable in any respect. This affords, however, no indication of the value of wood ashes when used in mixture as the sulphate and double carbonate of potash were used.

"The use of soluble phosphoric acid in greater or smaller quantity on soils upon which tobacco is grown continuously is necessary, though in a dry season, before the land has been long used for this crop, the addition of soluble phosphoric acid in considerable quantities may reduce the yield. At Donegal, notwithstanding the large excess used each year, the beneficial results of each application remained clearly marked. The alluvial soils of Bradford County exhibited less need for this material. It is probable that on the Bradford alluvial soil tobacco fertilizers should be used that contain less soluble phosphoric acid than is commonly found in commercial grades of fertilizer now offered on the market.

"The phosphoric acid in basic slag phosphate has proven rapidly enough available on the average arable soil to produce many vegetables and spring grains; it has, in these experiments with tobacco, given a marked increase in yield, but considerably less than the same weight of phosphoric acid used in the form of an acidulated phosphate."

Tests of fertilizers on wheat, D. O. Nourse (*Virginia Sta. Bul. 93, pp. 111–116, dgms. 3*).—These tests were begun in 1896. The results for the years 1896–1898, inclusive, have been previously noted and the general plan of the experiment described (E. S. R., 10, p. 1037). The present bulletin gives the results obtained in 1890 and compares them with those obtained in previous years. The average yields for the year show but little more than half a crop, but the relative effects of the different fertilizers accord entirely with the results obtained in previous years; *i. e.*, the greatest yields of both grain and straw have been produced on plats fertilized with all three essential elements, and the most effective of these elements has been phosphoric acid. Considered from a financial standpoint the results obtained for the whole 4 years of the test show that nitrogen and potash used alone or combined on the station soils have regularly resulted in loss. Phosphoric acid alone has proven more profitable than applications of potash, phosphoric acid, and nitrogen combined, though the yield per acre has been a little less. The greatest profit resulted from the combined use of phosphoric acid and potash.

Electricity in agriculture, G. S. HULL (*Pennsylvania Dept. Agr. Rpt. 1898, pt. 1, pp. 626–635*).—An historical summarization of experiments made with electricity in the culture of certain plants, with suggestions as to its further use in agriculture.

History of the practice of catch-cropping, P. HABERNEL (*Mitt. Landw. Inst. K. Univ. Breslau, 1899, No. 2, pp. 44*).—The author places the origin of the practice of catch-cropping in the period of the improved 3-year rotation. When the practice was introduced of growing an early-maturing crop in the first year of the rotation instead of allowing the land to lie fallow, we find the beginning of the culture of catch crops. The history of this practice of growing intermediate crops is reviewed, and the impetus given by Hellriegel's discovery of nitrogen assimilation and the present difficulties in the way of a more general culture of legumes are discussed. The problems in this connection which need investigation are the relations of climate and soil to legumes grown especially as catch crops, comparative tests of species grown for this purpose, and methods of utilizing the product. The article is accompanied by bibliographical references.

Some suggestions in the use of fertilizers, C. E. THORNE (*Pennsylvania Dept. Agr. Rpt. 1898, pt. 1, pp. 596–615*).—A suggestive popular article.

Relative effects of cotton meal, whole and crushed seed on the yield of corn, cotton, and potatoes, R. L. BENNETT (*Arkansas Sta. Bul. 58, pp. 104, 105*).—In these trials the relative effects of the different fertilizers on the long-growing crops, corn and cotton, were about the same, while on potatoes the advantage lay with the cotton-seed meal for the apparent reason that it was more readily available.

Economic value of maize, R. LOPEZ Y PARRA (*Bol. Red.Met. y Rev. Cient. México, 2 (1898), No. 10, pp. 107–109*).

Alfalfa in eastern Kansas, H. M. COTTRELL (*Kansas Sta. Press Bul. 51, p. 1*).—Notes on the nature and value of alfalfa as a farm crop in eastern Kansas.

Awnless brome grass (*Kansas Sta. Press Bul. 47, p. 1*).—Notes on the nature of this plant (*Bromus inermis*) and on its adaptability to Kansas.

Allen Hybrid cotton, R. L. BENNETT (*Arkansas Sta. Bul. 58, pp. 107, 108*).—This variety of cotton was compared with the variety Eldorado. "The Eldorado grows a little larger and has larger and less pointed bolls. The fiber of the Allen Hybrid is more silky and finer to the touch than Eldorado, but the latter is more productive and better for general cultivation."

Crimson clover, T. A. WILLIAMS (*U. S. Dept. Agr., Division of Agrostology Circ. 17, pp. 6, fig. 1*).—Popular directions for the culture of crimson clover (*Trifolium incarnatum*), with notes on its uses as hay and for soiling, pasturage, silage, green manure, and a soil cover. The plant is described and its conditions of growth given. Crimson clover "is too tender for successful general cultivation outside of the Middle and South Atlantic and Gulf States." It "has a high feeding and fertilizing value [illegible] best crops that can be grown in short rotations for forage and soil [illegible] . . . The seed should be sown in late summer or early autumn at the [illegible] 10 to 20 lbs. per acre on a well-prepared seed bed. . . . The crop should [illegible] at or before full bloom and for seed as soon as ripe; in the latter case [illegible] threshed or put under cover as soon as dry."

[illegible] leguminous forage plants, A. S. HITCHCOCK (*Kansas Sta. Press Bul. 52, p. 1*).—[illegible] clover, alfalfa, and soy beans are considered the most desirable legumes for [illegible] in Kansas. Notes are given on these and other forage plants and their [illegible] compared.

Grasses and forage plants. Part I, Domesticated grasses, J. B. KILLEBREW (*Tennessee Sta. Bul. Vol. XI, No. 2, pp. 72, pls. 2, figs. 40*).—Illustrated descriptions are given of 29 domesticated grasses growing in the vicinity of the station with cultural notes in each instance, and information regarding harvesting, marketing, and uses.

Grasses and forage plants. Part II, Domesticated leguminous plants, J. B. KILLEBREW (*Tennessee Sta. Bul. Vol. XI, No. 3, pp. 73–111, figs. 8*).—Popular cultural notes on 12 of the more important leguminous plants grown for forage in Tennessee.

Grasses and forage plants. Part III, Meadows and wild pastures, J. B. KILLEBREW (*Tennessee Sta. Bul. Vol. XI, No. 4, pp. 113–144, figs. 20*).—Popular directions for the establishment, care, and management of meadows in Tennessee, with formulas for mixing grass seed for planting lawns, orchards, and permanent pastures on different soils, and notes on some of the highway and mountain pastures of the State.

Influence of water and soil nutrients on the growth of potatoes, J. WILMS (*Jour. Landw., 47 (1899), No. 3, pp. 251–292, pls. 3*).

Yield of Spanish peanuts planted at different distances, R. L. BENNETT (*Arkansas Sta. Bul. 58, pp. 101, 102*).—Spanish peanuts were grown in rows 2 and 3 ft. apart, respectively, with hills 4, 6, 8, 12, and 18 in. distant in the row. The yields are tabulated. When the rows were 2 ft. apart, the yields averaged 140 bu. per acre annually; when 3 ft. apart, 109 bu. per acre. For the station soils, rows 2½ ft. apart are suggested, with hills 8 to 9 in. distant in the row.

Saltbushes, P. B. KENNEDY (*U. S. Dept. Agr., Farmers' Bul. 108, pp. 19, figs. 9*).—Notes are given on the general characteristics of saltbushes; on the distribution of saltbush seed by this Department, and on methods of growing the plants. Descriptions of 6 introduced and 6 native saltbushes of agricultural importance, and compiled data as to the feeding and fertilizing value of saltbushes make up the larger part of the bulletin. Several miscellaneous plants grown on alkali soils are also described and brief notes given on the characteristics of alkali soils.

Soy beans (*Kansas Sta. Press Bul. 46, p. 1*).—The planting, cultivation, and harvesting of soy beans are briefly discussed, as well as the cost of production, feeding value, and resistance to drought.

Experiments with sugar beets in 1899 and 1900, J. T. WILLARD (*Kansas Sta. Press Bul. 53, p. 1*).—"The results of the past 3 years confirm those of former years and indicate that while Kansas has produced many individual plants of excellent quality she has produced more of inferior quality, and that States in higher latitudes are better situated for successful sugar beet production." The samples grown within the State in 1899 averaged from 10.89 to 11.49 per cent of sugar in the beet with an average purity coefficient of from 73 to 75 per cent.

A further contribution to the knowledge of the tobacco plant, J. BEHRENS (*Landw. Vers. Stat., 52 (1899), No. 5–6, pp. 431–454*).—Includes a botanical and chemical study of the color of tobacco; inconclusive results of investigations relative to the cause of the blast ("mauche," "mauke") of tobacco, a disease similar in character to the mosaic disease of tobacco; and an account of experiments in breeding tobacco.

The growing and curing of wrapper leaf tobacco in New England and elsewhere, E. H. JENKINS (*Connecticut State Bd. Agr. Rpt. 1898, pp. 89–112*).

HORTICULTURE.

Horticultural division, F. W. CARD (*Rhode Island Sta. Rpt. 1898, pp. 106–110, pls. 7*).—Notes are given on some results in growing Longfellow flint corn in close proximity to sweet corn, on cross fertilizing watermelons, and on the root and top pruning of apple trees at the time of planting. In the experiments with corn "careful observations at husking time failed to show any kernels of the sweet corn type on the ears of the flint corn, though the yellow kernels were very numerous on sweet corn ears, being most abundant on ears taken from rows next the yellow corn." No influence on the color of the flesh resulting from crossing yellow and red-fleshed watermelons was observable.

The experiment in top and root pruning trees was carried out with two-year-old stock of the Northern Spy variety. Ten trees were treated in each of the following ways: (1) Two-year whips, (2) limbed trees pruned to a whip when set, (3) branches cut back one-half, leader left, (4) untrimmed, (5) roots untrimmed, (6) roots cut back one-half, (7) cut back closely, (8) Stringfellow method—roots cut back to a mere stump 1 or 2 in. long and the tree to a trunk about a foot high. Notes on the growth of the different lots are given. The methods of pruning and the root and top development of representative specimens are illustrated by photographs. All the trees made good growth, but the best results were obtained when all sound roots were left undisturbed.

Experiments in progress are noted in outline.

A comparison of large and small radish seed, W. M. MUNSON and L. J. SHEPARD (*Maine Sta. Rpt. 1898, pp. 158–160*).—Studies by E. R. Mansfield on the influence of the size of seed upon germination are reported. Comparisons were made of the yield of radishes from large and small seeds. In the first trial the number of first-class roots from 100 uniformly large seeds was about 30 per cent greater than the number from 100 uniformly small seeds, while the weight of the former crop exceeded the latter by about one-third. In a second trial, 300 seeds weighing 4.19 gm. produced 63 per cent of strictly first class roots, while the same number of seeds, weighing only 1.78 gm., produced only 13 per cent of the same grade of roots. In a third trial the number of first class roots produced by 200 seeds, weighing 2.8 gm., exceeded the number produced by 200 seeds, weighing only 1.2 gm., by about 28 per cent. In weight about the same difference was obtained. The conclusions drawn from the observations are stated as follows:

> "It is evident that plants from large seed grow larger and mature earlier than those from small seed. Inasmuch as the cost of seed is slight as compared with the cost of labor and fuel, and in view of the importance of having the crop ready for market in the shortest possible time, the gardener can well afford to sift the seed before planting and discard all which is small and inferior. For the purpose of sifting, common wire cloth which is used for window screens ($\frac{1}{12}$-inch mesh) will answer, though a screen with $\frac{1}{16}$-inch mesh is better, as many of the small seeds will not readily pass through the window screen."

The effect of subwatering radishes, W. M. MUNSON and L. J. SHEPARD (*Maine Sta. Rpt. 1898, pp. 161–163, pl. 1*).—An account of the experience of the authors in growing radishes, in which the yield from subwatered and surface-watered benches was compared. In one trial "the plants which were subwatered were superior to the others from the beginning. At the time of harvesting the number of first-class roots on the subwatered section exceeded that on the surface-watered section by [illegible] per cent, while the average weight was 14.5 per cent greater." In a second trial the advantages of subwatering as compared with surface-watering were demonstrated on a commercial scale. There was little difference in germination in the 2 lots, but very many more plants were lost by damping off on the surface-watered section than on the other.

> "The subwatered section yielded twice as many bunches of marketable roots as did the other. The percentage of marketable roots was much higher and the average size greater from the subwatered section. The difference in the yield of the two sections was more than enough to make the difference between profit and loss in growing the crop. . . . More than half of the roots [from the subwatered section] were classified as 'second-class and culls.' It should be said in explanation that about half of the number so classed were simply of small size; many of them were inferior or diseased; others were of good size and quality, but badly disfigured by attacks of millipedes.
>
> "The number of roots attacked by millipedes was much greater on the subwatered section—a significant fact in connection with the control of this pest. The number of diseased and inferior roots was much larger on the surface-watered section. This, together with the fact previously noted, that there was much more trouble from 'damping off' on this section, is also significant. The injured roots were mostly of marketable size, but deformed."

Fruits of Oklahoma, O. M. MORRIS (*Oklahoma Sta. Bul. 13, pp. 12*).—An account, based on the reports of 37 growers, is given of the different varieties of orchard and small fruits most successfully grown in different parts of the Territory. Orchards and vineyards located on the richer bottom lands have generally given better results than on uplands, though upland orchards usually come into earlier bearing. Apples, plums, pears, peaches, and grapes have been grown successfully in nearly all portions of the Territory. Sweet cherries succeed with difficulty but sour varieties have been successfully grown on nearly all soils. Blackberries, apricots, currants, and raspberries have been only partially successful. Lists of favorite varieties of the different orchard and small fruits for both commercial and home orchards are given, and suggestions added regarding desirable shade trees and methods of planting them.

Peach culture in Canada, J. CRAIG (*Canada Cent. Expt. Farm Bul. 1, 2. ser., pp. 45, figs. 19*).—This is a manual of peach culture as adapted to local conditions in Canada. A summarized statement is made of the experience and practice of a number of growers in Ontario. Notes are given on peach yellows, leaf curl, fruit rot, mildew, black spot, root galls, borer, curculio, and aphis. An unidentified and apparently contagious disease of the peach which has appeared in orchards in Ontario is characterized. A preliminary study was made of the relative hardiness of the fruit buds of different varieties. A list of varieties, in the order of hardiness, is tentatively submitted as follows: Hill Chili, Longhurst, Barnard, Early Rivers, Salway, Smock, Tyhurst, Wager, Yellow St. John, Amsden June, Hyne Surprise, Hale Early, Fitzgerald, Foster, Reeves Favorite, Crawford Late, Crawford Early, Wheatland, Mountain Rose, Early Richmond, Red Cheek Melocoton, Old Mixon, Alexander, Early York, Garfield, Champion, Shaw Rareripe, and Stephen Rareripe.

Effects of the February freeze of 1899 upon nurseries and fruit plantations in the Northwest, E. S. GOFF (*Wisconsin Sta. Bul. 77, pp. 18, figs. 2*).—A circular letter of inquiry requesting information as to the injuries to fruit trees caused by the February freeze of 1899 was sent to fruit growers and nurserymen in Wisconsin, Minnesota, Iowa, the Dakotas, and Manitoba. More than 100 replies were received, and extracts from these are given in notes and tables. The lowest temperature recorded was —52° F. Nursery apple stock least injured by the freeze was Duchess of Oldenburg. Hibernal, Wealthy, and Whitney No. 20, in the order named. Twenty-three correspondents reported Wealthy least injured in the orchard, 21 Duchess of Oldenburg, 9 Yellow Transparent, and 6 Hibernal. Fifty-seven correspondents reported that the ground was destitute of snow at the time of the freeze, and of this number 43 stated that "the principal damage to nursery and orchard trees was to the root, while only 3 thought the damage greater in the tops than in the roots." Of the 34 correspondents who reported the ground covered with snow, "20 reported that the injury was chiefly in the top and 6 stated expressly that there was no root injury." Crabs were less injured than common apples, and this fact suggests the advisability of using crab roots for stock in the Northwest.

The blossom buds of 18 varieties of cherries at the station which had been exposed to a minimum temperature of —27.5° F. were examined. The results which are tabulated show the percentage of live buds to vary from 5.7 in the case of Bessarabian to 98.5 in the case of the large Morello. Relative to plums the author states that "the Japanese plums appear to have suffered more, as a rule, than the European. The Chicasaw plums appear to have suffered nearly as much as the European, but the American class have vindicated their claim to perfect hardiness so far as their flower buds are concerned. The young trees, however, while they have perhaps endured better than those of any other fruit, have not been wholly exempt from root killing."

The Loudon red raspberry "seems to have endured the conditions better than most other red varieties." Several red varieties are reported to have endured a temperature of —50° F. at Manitoba without protection. Of the Black Caps the Older proved to be most hardy. Blackberries, generally, suffered severely. "The Snyder blackberry demonstrated its superior hardiness in many cases."

The results of the injuries suggest the value of a snow covering for nursery stock; and to this end it is advised that nurseries be planted, so far as practicable, on north slopes, and the nursery blocks interspersed with evergreen wind-breaks extending east and west. Next in value to a snow covering is a covering of litter. Oats, buckwheat, peas, vetches, or mammoth clover are advised as catch crops for this purpose. Mammoth clover is advised only in wet seasons. It is thought by the author that "had the crab been generally used for root grafting the apple in the Northwest, the loss from root killing would have been reduced at least one-half." Plums should be worked on American seedlings and the cherry on the Mahaleb stock.

The blueberry in Maine, W. M. MUNSON (*Maine Sta. Rpt. 1898, pp. 164–172, figs. 5*).—An account is given of the blueberry industry in Maine, with botanical descriptions of the dwarf or low-bush blueberry (*Vaccinium pennsylvanicum*), low black blueberry (*V. nigrum*), velvet leaf or "sour top" (*V. canadense*), and high-bush blueberry (*V. corymbosum*). Culture experiments with blueberries by horticulturists in Massachusetts are reported.

> "In New England the term 'blueberry' is applied indiscriminately to various species of Vaccinium, particularly to *V. pennsylvanicum*, *V. vacillans*, and *V. canadense*. *V. corymbosum* is known as the high-bush blueberry.
>
> "The species most commonly found are, in the order of their commercial importance, *V. pennsylvanicum*, *V. canadense*, *V. corymbosum*, *V. nigrum*, and *V. vacillans*.
>
> "The 'blueberry barrens' of Maine are mainly in Washington County and are about 150,000 acres in extent. There are, however, many thousand acres in other parts of the State that are or might be made profitable blueberry lands.
>
> "Blueberry lands that are treated systematically are usually burned over every third year for the purpose of renewing the bushes and of checking the growth of the alders, birches, etc. Lands bearing the high-bush blueberry are seldom burned over.
>
> "The station is now making an effort to introduce several species into cultivation. This is done by transfering some of the most productive and largest fruited plants to the garden, and by growing seedlings from selected fruit.
>
> "The few attempts that have been made at garden culture of the blueberry, indicate that with care satisfactory results may be obtained."

Strawberry notes for 1899, L. R. TAFT and H. P. GLADDEN (*Michigan Sta. Bul. 176, pp. 14*).—Data as to sex, vigor, blooming period, first and last ripe fruits, productiveness, size, form, color, quality, and firmness are tabulated for 160 varieties of strawberries grown at the station in 1899. Descriptive notes are given of 103 of these varieties.

> "The most promising of the new sorts are: Excelsior, Flash, Lady Franklin, Nick Ohmer, Ponderosa, Sample, See No. 3 and No. 4. Of the varieties that have been grown for 2 seasons, the following have made the best showing: Bryant, Fountain, Hoosier, Knight, Morgan Favorite, and Ridgeway. Bubach, Haverland, Lovett, and Warfield, with Beder Wood, Sharpless, or Clyde as fertilizers still have a place as money-making sorts. If fancy fruit under intensive culture is the object of the grower, he will find in Brandywine, Glen Mary, Marshall, and Wm. Belt sorts well worthy of his attention. Mayflower as an early berry and Michigan for late are worthy of trial for the purpose named."

The experimental vineyard—second report, W. B. ALWOOD (*Virginia Sta. Bul. 94, pp. 119–143, figs. 6*).—A revised edition of Bulletin 30 of the station (E. S. R., 5, p. 873). The establishment, planting, and training of young vineyards, especially for home use, are considered. The low-headed recurved fan system and the high-headed Y Kniffen system of pruning are described in detail, original illustrations being given of partly pruned vines at different stages of growth. Descriptive notes are given of 39 varieties of black grapes, 28 of red, and 44 of white grapes growing at the station.

The following varieties are recommended for general culture in Virginia:

"*Black grapes.*—For table and market: Concord, Moore, Early Market, Ives (not a good table grape unless well ripened). For wine: Clinton, Cynthiana, and Norton. Ozark has some promise as a late-market grape.

"*Red grapes.*—Brilliant and Delaware for table and market. Brighton for table. Ulster a fair table grape, late.

"*White grapes.*—Willie Bell, Niagara, Winchell, and Martha for both table and market. Elvira and Elpo for wine; also good for table. Lady and A 193 for table."

The same varieties are classified according to season as follows:

"*Very early:* Lady and Moore. *Early:* Early Market and Willie Bell. *Medium early:* Eumelan, Amber Queen, Geartner, and Brighton. *Medium:* Salem, Concord, Delaware, Niagara, Brilliant, Winchell, Olita, Ideal, Ives, Peter Wylie, A 193, Duchess, Cynthiana, and Norton. *Medium late:* Elvira, Martha, Elpo. *Late:* Ulster, Lady Washington, Ozark, and Clinton."

Chemical fertilizers on vines in 1899, E. SCHUARD and C. DUSSERRE (*Chron. Agr. Canton Vaud, 12 (1899), No. 24, pp. 519–521*).—Experiments were made to see if the enormous quantities of barnyard manure used in fertilizing vines could not be replaced in part by commercial fertilizers. Three plats were used in the test. One received the usual amount of barnyard manure; the second one half this amount and in addition sulphate of potash at the rate of 2,000 kg. per hectare and superphosphate at the rate of 500 kg. per hectare, or Thomas slag at the rate of 1,000 kg. per hectare, and the third the same fertilizers as the second, and in addition 400 kg. of nitrate of soda per hectare.

The plats receiving the mixed fertilizers gave increased yields over the plat receiving the barnyard manure alone. Plat 2, which received no nitrate of soda, yielded at the rate of 690 liters of wine per hectare, while plat 3, which received nitrate of soda, yielded at the rate of 775 liters of wine per hectare. The fear that the increase in yield would be accompanied by a decrease in the quality of wine proved to be unfounded, as the reverse was true and the wine obtained from plat 3 was of better quality than that obtained from either of the other plats.

Dependence of the fruit development of grapes and some other fruits on the development of the seed, H. MÜLLER-THURGAU (*Landw. Jahrb. Schweiz., 12 (1898), pp. 135–205, pls. 4; abs. in Centbl. Agr. Chem., 28 (1899), No. 12, pp. 828–839*).—The author reports the results of an extended study on the dropping of grapes; the origin of seedless grapes; seeds in normally developed grapes; influence of seed on the size, form, and color of grape berries; dependence of the ripening of fruit on the development of the seed, and on similar relations in other fruits.

Dropping of grapes.—It has been held that the early dropping of grapes was due to nonfertilization. The author shows that fertilization, in the ordinary meaning of that term, is not necessary for the development of grape berries, but that the growth of pollen in the pistil of the flower, even if no pollen tube penetrates the ovule, exercises such a stimulating influence that full-sized berries may develop and ripen, though no seed is formed. When no pollen growth in the stigma or ovary occurs, further development is prevented and the ovary soon withers and drops off. According to the author's investigations, the causes which prevent the growth of pollen in the stigma and ovary and thus occasion the dropping of the undeveloped berries are 3 in number: Outer deformities of the flower; inherited inner deformities, chiefly abnormal metabolism, and unfavorable environment.

Relative to outer deformities, the frequent occurrence among varieties of grapes, especially among American varieties of *Vitis riparia* having flowers with well-developed stamens and anthers, but with more or less stunted pistils, are noted. Further, it is noted that flowers may have well-developed pistils but degenerate anthers, so that fertilization can take place only through insect visits or by the aid of the wind. Such varieties are yearly subject to the dropping of the immature green fruit to a marked degree. Where these conditions prevail, the remedy is to immediately remove such vines from the vineyard. The ease with which the deformed flowers can be detected makes the application of this method of handling practicable.

In other instances, flowers may be seemingly perfect in their organs and yet fail to develop fruit. Many experiments were made with such vines, which were subject to the dropping of the fruit, by ringing them from 8 to 14 days before the blossoms opened, on the canes beyond the first shoots reserved for wood development. The ringed vines produced normal sized, though usually seedless, fruit, while the fruit on the vines not ringed nearly all dropped off soon after the blossoming period. Partial ringing of the vines, pinching off the tips of the shoots, or pruning away part of the flowers was of no benefit whatever. A practical consideration in this connection is to carefully avoid the use of scions for planting which originate from vines regularly subject to the dropping of their fruit, since these scions are certain to perpetuate the undesirable qualities of their parents. The author holds that the ringing of the vines does not cause a change in the structure of either stigma or ovary, but does, through better nourishment, occasion a change in the functional capabilities of these organs. A more abundant and more suitable secretion is formed on the stigma, and the chemical constituents of the cells of both stigma and ovary are, in a measure, changed.

The results of the author's experiments led to the conclusion that one of the real causes of the dropping of the grapes is an insufficient or unsuitable nourishment of the flowers with organic food. Ringing lessened the amount of water supplied, and concentrated the liquid nourishment carried to the flowers. In this connection the author examined comparatively ringed and unringed grape shoots for sugar. Examinations of such shoots made at the end of from 3 to 5 days showed practically no difference in sugar content. At the end of [illegible] days ringed shoots averaged 1.7 per cent sugar content and unringed shoots 1.4 per cent. At the end of 20 days ringed shoots averaged [illegible] per cent sugar content, and unringed 1 per cent. In cold, wet weather the sugar content of ringed and unringed shoots was reduced to 0.08 and 0.04 per cent, respectively. The author recommends ringing the canes bearing the shoots rather than ringing the individual shoots, as is frequently done, since it secures the same results and lessens the danger of the shoots breaking off. If the width of the ring is limited to 2 to 3 mm., the wound heals over after it has fulfilled its purpose, and the vines then develop normally.

The method of pruning was also found to influence the dropping of grapes. Certain varieties, as, for example, Gumpoldkuchen, must be pruned long in order to secure the least dropping of the fruit, while Elbling required short pruning.

As to the influence of environment on the dropping of fruit, excessive dry weather, long-continued cold, rainy weather, or a long period of low temperature alone have been found conducive to the dropping of the fruit. Short periods of rainfall, on the other hand, or a longer period of warm rainfall, did not seem to further the dropping. Low temperature is thought to exercise an unfavorable influence on the metabolism of the flowers; evaporation and the formation of sugar in the leaves are retarded, as is likewise the solution and utilization of organic reserve material.

Origin of seedless grapes.—Seedless grapes occur whenever the growth of pollen takes place in the stigma and ovary, but, when for any reason, impregnation of the ovule fails to take place. These grapes ripen earlier than normally developed grapes and are much smaller in size. The cell walls are thinner and they are in general much less compactly formed. The author gives comparative measurements of the grape pedicel and of the epidermis, bast layer, wood, pith, etc., of the same. The measurements show the average diameter of the pedicel of normally developed grapes and of the other parts mentioned to be nearly 3 times greater than that of seedless grapes. Considerable data is given relative to the comparative weights of normal and seedless grapes and of the sugar and acid content of the same at different dates of gathering. The data show that the process of ripening takes place much earlier in the seedless grape. At vintage time these grapes are overripe; they are usually commencing to wrinkle, and are subject to the harmful working of wasps, bees, and fungi.

The author's investigations led him to arrange the causes which conduce to production of seedless grapes under 3 heads: (1) The pollen tube may extend into the ovary, but fail to penetrate the ovule. The fruit in this case develops, but is small and no seeds are formed.

The varieties Aspirant, Pearl, Grobriesling, and the Corinthian raisins of commerce belong to this group. (2) The pollen tube may penetrate the ovule, but the ovule be incapable of fertilization. The seeds in this case show a somewhat greater development than in the first case and the berries are a little larger. The varieties Corinth and Sultana belong to this group. (3) The ovules may be capable of fertilization, but the pollen defective. If the pollen fails to germinate, no fruit whatever develops and the blossoms soon drop off. Such grapes may be fertile when supplied with effective pollen. The varieties White Damascus, Madeline Agevine, and "Olivette Noire" often contain specimen vines which come under this head.

Number of seeds in normal grapes.—A normal grape ovary contains four ovules. These seldom all develop. The author examined 100 ripe berries of each of 22 varieties. A few of the same varieties were also examined in different years, and in one experiment the number of seeds in grapes protected from foreign pollen and outer influences by sacks placed over the bunches before blossoming was determined. These data are tabulated. Berries containing 1 or 2 seeds were found most abundant. Then came seedless berries, followed by three-seeded and four-seeded berries. Nonprotected berries contained but few more seeds in 100 berries than berries protected before and during the blossoming period with sacks. Newly cultivated sorts, as certain American varieties, usually contain a larger number of seeds than older European varieties.

The weather seems to exercise an influence on the number of seeds which develop. The average number of seeds in 100 berries of 4 varieties in 1888 was 160; in 1889, 225; and 1890, 142. Planting different varieties together had no apparent influence on the number of seeds in the berries.

Influence of the seed on the size, form, and color of grapes.—The data given on this subject show that the size of the grape berry increases regularly with the number of seeds it contains. The average weight of the flesh of seedless grapes taken from a large number of varieties was 42.7 gms. The average weight of the flesh of one-seeded grapes was 144.5 gms.; of two-seeded grapes, 204.2 gms.; of three-seeded grapes, 253.6 gms.; and of four-seeded grapes still greater. The data also show that the better the seed development the larger the size of the berry. One well-developed seed exercises a greater influence on the flesh development of the berry than two poorly developed seeds.

The form of the berries is influenced by the seed. Seedless berries are practically round, while berries containing seeds are more oblong. No relation between the color of the fruit and the number of seeds contained in the berry could be discerned.

Dependence of ripening on the development of the seed.—Extended examinations with reference to the sugar and acid content of different varieties of grapes gathered at different dates and containing no seed, and 1, 2, or 3 seeds, led the author to the following conclusions: (1)

The sugar content is highest in the seedless grapes, and these grapes are also ripest. One-seeded grapes stand next in percentage of sugar, followed by the two-seeded and three-seeded grapes. (2) The acid content is least in the seedless berries and greatest in the three and four-seeded berries. (3) Both the sugar and acid content increased absolutely with the increase in the number of seeds in the berry, and the acid content increased more rapidly than the sugar content.

Berries which contained only 1 or 2 seeds began ripening first on the side containing no seed. A microscopical examination of the pedicels of one-seeded berries showed that the different stages of ripeness of the 2 halves of the berries could be seen in the corresponding halves of the pedicel. The half of the pedicel on the seedless side was not only weaker in development but also poorer in starch content, signifying that berries when ripening draw on the reserve starch content of the pedicel. Unfavorable conditions, as cold or the development of seed in the berry, which stimulates and therefore prolongs the period of growth of the flesh, retard the ripening process. The more seeds in the berry the greater the stimulation and therefore the longer the period of growth, the greater the size of the berry, and the later the period of ripening.

The use of cuttings from vines which are subject to the production of seedless berries should be avoided. The aim should be to select vines for planting which produce grapes having a uniform number of seeds in the berry. The product will then be uniform in size and ripen at the same time.

Relation to other fruits.—Investigations similar in character to those conducted with grapes were made by the author with certain orchard and bush fruits which show that the general principles involved in the seed production, fruitfulness, growth of flesh, and ripening of the fruit of grapes have a general application to other fruits. An outline of the author's work along this line is here reported, but the greater part of the details are reserved for a future report. With both apples and pears, fertilization of the ovaries is not necessary to the production of fruit. The penetration of the pollen tube into the ovary exercises sufficient stimulation to cause a production of fruit. Seedless apples and pears are not found as often as seedless grapes, but they do occur. With currants the largest berries were generally found to contain the greatest number of seeds. When 2 berries were of equal size, the berry containing the least number of seeds ripened first. The author was unable to determine whether seedless apples and pears ripened before those containing seed.

In the case of apricots and nectarines only one of the two ovules present develops into a seed, the other remaining an empty sack. The half containing the developed seed is not only more completely rounded out, but the flesh is much firmer. This development gives to these fruits their peculiar unsymmetrical form.

Manual of practical viticulture, M. E. Durand (*Manuel de viticulture pratique. Paris: J. B. Baillière & Sons, 1900, pp. 400, figs. 146*).

Culture of asparagus (*Semaine Agr., 20 (1900), No. 973, p. 5*).—Methods followed in the vicinity of Paris.

Culture of peas and the manufacture of pea products, A. DE CÉRIS (*Jour. Agr. Prat., 1900, I, No. 4, pp. 133–138, figs. 2*).—The culture of peas for canning is considered and a description given of factory machinery and pea canning operations. The use of the pods as a green and preserved fodder is considered.

Winter budding, H. M. STRINGFELLOW (*Nat. Nurseryman, 8 (1900), No. 1, p. 5*).—Detailed directions for winter budding are given.

Pomology in Rhode Island, L. W. RUSSELL (*Rhode Island State Bd. Agr. Rpt. 1898, pp. 29–49*).—Lists of orchard and small fruits most successfully cultivated by growers throughout Rhode Island, with comments by the different growers; and suggestions for locating and managing orchards with reference to Rhode Island conditions.

Cultivation of bush apple trees (*Garden, 57 (1900), No. 1469, p. 34*).—Directions for planting, with notes on the most desirable varieties.

Peach growing in New Jersey, S. S. VOORHEES (*Pacific Rural Press, 59 (1900), No. 6, pp. 84, 85*).—A paper read before the State horticultural society covering the different phases of peach production and with special reference to marketing.

The balance sheet of a small Maryland peach farm, W. B. STOTTLEMYER (*Amer. Mo. Rev. of Reviews, 21 (1900), No. 122, pp. 317, 318*).—A review of the industry and a statement of profits.

Plum culture in England, F. HOOD (*Fuhling's Landw. Ztg., 49 (1900), No. 1, pp. 24–28*).—Methods of culture and varieties are considered.

Variation in Japanese plums and Japanese chestnuts, G. H. POWELL (*Amer. Gard., 21 (1900), No. 265. p. 38*).—Variations in ripening period and fruiting habits of the same varieties of Japanese plums and Japanese chestnuts in different years are noted.

The grape belt and its product (*Sci. Amer., 82 (1900), No. 8, p. 118*).—A description of the condition of grape growing in western New York and northern Ohio.

Spacing vines in new plantations, A. CARRÉ (*Prog. Agr. et Vit. (Éd. L'Est), 21 (1900), No. 2, pp. 42–47*).—The best distances apart for setting vines on poor, medium, and rich soils are considered.

Preserving fruit (*Queensland Agr. Jour, 6 (1900), No. 1, pp. 65–67*).—Home methods for canning fruits and making preserves and jam.

Gardening under glass, W. WATSON (*Gard. Chron., 3. ser., 27 (1900), Nos. 680, pp. 1, 2; 681, pp. 17, 18; 682, pp. 34, 35; 683, pp. 52, 53*).—Practical suggestions on greenhouse management.

Cheap greenhouses and substitutes, W. S. ABBOTT (*Success with Flowers, 10 (1900), No. 5, pp. 104, 105, figs. 4*).—Directions for construction, with drawings.

The hygrometer in our greenhouses, L. WILD (*Amer. Gard., 21 (1900) No. 268, pp. 96, 97*).—The subject is considered with especial reference to rose houses and graperies.

Growing carnations under glass all summer, J. HARTSHORNE (*Florists' Exchange, 12 (1900), No. 7, p. 159; Amer. Florist, 15 (1900), No. 611, pp. 837, 838*).—The advantages of this method of growing carnations are pointed out and the details of growing described.

Propagation of Drosera binata (*Amer. Gard., 21 (1900), No. 269, p. 117, fig. 1*).—This plant has been successfully grown by placing the leaves, cut into small sections one-half an inch or more in length, on sphagnum and sand. Several plants grow from each section.

Propagating violets, E. J. (*Gard. Illus., 21 (1900), No. 1089, p. 627*).—Propagation by runners is especially considered.

Effect of electric light on Easter lilies, M. G. KAINS (*Florists' Exchange, 12 (1900), No. 6, p. 131*).—From his preliminary work the author says "the light might be used to advantage after the buds are an inch long in order to make them expand sooner than they naturally would."

Horticulture in Holland, J. K. L. M. FARQUHAR (*Rhode Island State Bd. Agr. Rpt. 1898, pp. 203–212*).—Lecture on flower and bulb culture in Holland, delivered by the author before the Rhode Island Horticultural Society.

The beech and its varieties (*Garden, 57 (1900), No. 1471, pp. 64, 65, fig. 1*).—Different varieties of cultivated ornamental beeches are described.

A new evergreen (*Nat. Nurseryman, 8 (1900), No. 1, p. 4, fig. 1*).—A description, accompanied by an illustration, is given of a hybrid evergreen tree originated by crossing Golden Arborvitæ with *Rentinospora squarrosa*. The tree is a dwarf and grows but 6 or 8 ft. high.

FORESTRY—SEEDS.

Practical forestry in the Adirondacks, H. S. GRAVES (*U. S. Dept. Agr., Division of Forestry Bul. 26, pp. 85, pls. 20*).—This bulletin states the general conditions which govern forest management in the Adirondacks, and gives a report of the work already done and results accomplished in that region under the cooperative plan previously described (E. S. R., 10, p. 443).

The forestry problem of the Adirondacks is discussed in detail, with special reference to 2 private preserves amounting to about 100,000 acres which are under special consideration. A description is given of these tracts and of the forests growing on them, and a special study of the habits, growth, and production of spruce, with mention of associated species. In connection with the special working plan, the loss occasioned by ordinary lumbering is discussed in detail, to show the advantage of conservative methods.

The author discusses an American system of forestry, as opposed to that usually known as the European system. The latter system contemplates the maintenance of a sustained annual yield, the removal of dead and unsound trees, thinnings and improvement cuttings, permanent roads, planting, and fire lines. While this system may be adapted to European conditions, it fails in application in this country for many reasons. The system of management advocated contemplates the removal of the spruce, that being the principal market material, above 10 in. in diameter at 3 ft. from the ground, except seed trees needed to restock the opening made in lumbering. By observing this plan of cutting, it is believed that the original cut may be obtained again in from 30 to 36 years. The owners of the preserves are satisfied with the income thus obtained, and satisfactory contracts with lumbermen can be made.

In a number of respects the first year's work proved unsatisfactory, but it is confidently asserted that the second year's lumbering is beginning under better conditions and with the promise of great improvement in the character of the work.

The form of agreement under which this work is being conducted, rules for cutting, and volume and yield tables are given, the latter being quoted from "The Adirondack Spruce" by Gifford Pinchot.

Natural reproduction of forests in old fields in eastern Kentucky, S. C. MASON (*Forester, 5 (1899), No. 11, pp. 251–255*).—After reviewing the geological conditions of the area covered by this report, the author gives an account of the natural reforestation of a number of old fields. The original timber over this region consisted of oaks, sweet gum, cherry, sassafras, maple, chestnut, hickory, and large numbers of Jersey scrub pine, with occasional specimens of yellow pine. Most of this had been cut off and the fields cultivated for some time, after which they were abandoned.

In the first field, upon which cultivation ceased about 15 years before the observations, there was a complete stand of young pines, mostly *Pinus virginiana*, with about 10 per cent of yellow pine. There were a few oaks and hickories, but their number was insignificant.

In the second field, which had been abandoned for about 40 years, there was a complete stand of pine, though some trees had been cut. The stand was about one tree to every 8 sq. ft. On an average the specimens of *P. virginiana* were found to be 9½ in. in diameter 2 ft. from the ground, showing 38 growth rings on the stump. A small mixture of yellow pine was observed, but from the testimony of the owner and from evidence presented, it seems that the black pine overtops the yellow to the serious injury of the latter. One specimen of yellow pine was 8.5 in. in diameter and 59.5 ft. high, and showed 37 growth rings at 2 feet.

The third field was partially situated in a hollow, and has practically the same history as the second. Instead of a full stand of trees, they are arranged in groups and are heavier, shorter, and broader topped, except in the center. The yellow pines under such conditions form a clear trunk for a considerable distance, the young trees seeming to do this under their own cover. On the sides of the hollow the stand is fuller, both species of pine being about equally represented. Many trees were observed which were 10 and 12 in. in diameter, and again the yellow pine presented straighter and cleaner trunks.

The fourth field was located on a rather thin gravelly soil on top of a limestone bluff, and had been abandoned for about 20 years. The growth was wholly of black pine and was exceedingly dense, the average height of the trees being about 20 ft., with a diameter of 3 in.

The fifth field reported upon had been in cultivation for a long time, and at one time contained an orchard, but had been abandoned for about 40 years. Upon this the predominating growth was hard wood, though some pines were present. The growth was very dense and the young trees reached up to 50 or 70 feet, with clean, straight trunks clear of branches from 20 to 40 feet. The cover was almost perfect. The species most numerous were black and falcate oaks, some of which were a foot in diameter. White oaks were next in number, followed by black oak, hickory, and at the lower end of the field a number of poplars (*Liriodendron tulipifera*).

The sixth field was cultivated for a number of years, but the last crop raised upon it was in 1864. It is now entirely covered with a full growth of thrifty timber, more than half of which is poplar or whitewood.

Specimens of this tree a foot from the ground were 17 in. in diameter and showed 33 growth rings, which would indicate that the age of the tree was about 34 or 35 years. Two species of hickory were present in considerable quantity, and a large number of black locusts had been cut from the tract for posts.

On the influence of different degrees of thinning on the growth of beech, A. C. FORBES (*Trans. Roy. Scot. Arbor. Soc., 16 (1899), pt. 1, pp. 116–122*).—The author reviews the statements made by Schwappach relative to the growth of beech woods in Germany and comments upon the different methods adopted for thinning. The general conclusions of Schwappach are concurred in, and the author believes that the best results can be obtained by at first confining attention to the removal of rubbish, beyond which little is required until the thirtieth year on good, or forty-fifth year on bad, soils, and at that time the main-crop thinning should begin. About every six years the woods should be gone through and all badly shaped trees taken out, groups of well-shaped trees isolated, and all dead and dying ones removed. When this has been done 6 or 7 times, the crowns of the best trees should meet at about their seventieth or eightieth year. After this, stronger thinnings, bordering on light fellings, may be begun and recur every 8 or 10 years, removing the poorest and leaving the best trees. In this way about 1,000 ft. of timber per acre should be obtained every 10 years.

Root suckers on Douglas fir, F. H. LAMB (*Bot. Gaz., 28 (1899), No. 1, pp. 69, 70*).—The occurrence of stool shoots among deciduous trees is said to be very common, but among conifers, so far as present information goes, they are confined to California redwood, California nutmeg tree (*Tumion californica*), and the short-leaved or yellow pine (*Pinus echinata*). The author reports having observed similar outgrowths from the Douglas fir in the forests of western Washington. These growths, which are commonly called sap suckers, range in height from 0.6 to 3.5 meters, are without leaves or branches, and appear entirely lifeless until cut. Examination shows that they are covered with a living bark, and beneath that a living woody tissue which possesses a very fine-grained, intricate burl. These sap suckers are only a secondary growth from ordinary root suckers, and are found only in the most moist and dense forests, and even under those conditions are reported as being very rare.

What forestry means to the United States, J. WILSON (*Forester, 5 (1899), No. 12, pp. 271–275*).—A paper by the Secretary of Agriculture, in which attention is called to the value of forests and the necessity of their conservation and management.

The effect of forests on water supply, H. HAWGOOD (*Forester, 5 (1899), Nos. 11, pp. 247–251; 12, pp. 279–281*).—A résumé is given of the present information relating to the effects of forests on the conservation of water supply.

The State and forestry, W. S. MELICK (*Forester, 5 (1899), No. 8, pp. 178–181*).—The author suggests that there should be a formulation of systems of protection and propagation in forestry, after which an attempt should be made to introduce the system by the education of the people and by proper legislation.

The forest problem in the West, A. KINNEY (*Forester, 5 (1899), No. 9, pp. 200–203*).—A paper read before a meeting of the National Forestry Association, in which the peculiar forest conditions of the West and Southwest are stated.

The practical in forestry, W. W. EVERETT (*Forester, 5 (1899), No. 12, pp. 275–278*).—This paper treats, from the lumbermen's standpoint, the various ideas concerning lumbering, forest conservation, and reforestation.

Second-growth pine vs. agriculture, E. BRUNCKEN (*Forester, 5 (1899), No. 11, pp. 255, 256*).—The author reviews the condition of cut-over pine lands in Wisconsin and Minnesota, and draws the inference that while some kind of agriculture can be carried on over a considerable portion of these tracts, the interest of the settlers and people themselves is rather in the line of forest preservation and management.

The restoration of denuded forest areas by pasturage, J. A. GUNDY (*Pennsylvania Dept. Agr. Rpt. 1898, pt. 1, pp. 588–596*).—The author maintains that pasturing cut-over lands after the young seedlings have obtained a height when their crowns can not be reached by stock, will prove not only beneficial to forests by keeping down forest fires, but sufficiently remunerative to make the fencing of denuded areas profitable.

Pure forests and mixed forests, D. BRANDIS (*Trans. Roy. Scottish Arbor. Soc., 16 (1899), pt. 1, pp. 13–24*).—The advantages and disadvantages of pure and mixed forests are pointed out, the advantages of pure forests being that their management is simple and easy, while the disadvantages are the greater liability to damage by wind and sun, insects, and fungus diseases. The author describes a number of pure and mixed forests, and proposes a method whereby the oak and Scotch pine forests may be converted into mixed woods.

The growth of reserve trees after lumbering, E. HENRY (*Bul. Soc. Sci. Nancy, 2. ser., 16 (1898), No. 33, pp. 1–14*).

Forest thinnings, BROILLIARD (*Trans. Roy. Scottish Arbor. Soc., 16 (1899), pt. 1, pp. 100–115*).—The author discusses the necessity of forest thinnings and the problem in relation to the requirements of a number of different species of trees. The general statement is made that no definite formula for thinning can be laid down, as there is no process or equation by which one can determine the number of trees to remove or which ones are to be cut. This must be done through a knowledge of the various species, their requirements, exigencies, mutual relations, etc.

Height growth in forestry plantations, J. SIMPSON (*Gard. Chron., 3. ser., 26 (1899), No. 662, pp. 187, 188*).—The influence of location of plantations on growth in height is pointed out and numerous instances of growth cited.

A plan for the management of the woods of the Novar Estate for twenty-five years, F. BAILEY ET AL (*Trans. Roy. Scottish Arbor. Soc., 16 (1899), pt. 1, pp. 25–95*).—Working plans are given for forests embracing nearly 4,000 acres, the principal stock of woods being Scotch fir, larch, spruce, Douglas fir, and various hardwoods. The past management of the forest is reviewed and the plan outlined for the future.

Notes on the Raith and Novar working plans, R. C. M. FERGUSON (*Trans. Roy. Scottish Arbor. Soc., 16 (1899), pt. 1, pp. 96–99*).—The author comments upon the working plans that have been adopted for these estates.

A forestry experimental station, A. C. JOHNSON (*Forester, 5 (1899), No. 8, pp. (185–187)*).—An account is given of the forestry station at Santa Monica, Cal. At this place a large number of trees have been tested in a more or less satisfactory manner. It has been found that *Eucalyptus globulus* and *E. robusta*, although succeeding well in some regions, are not adapted to the Foothills Region. Several varieties have been found suited to this purpose and it is thought that probably others can be found. The advantage of such experiments, properly conducted, is pointed out, and better support is urged for similar institutions.

Supplementary report of the commissioner of forestry, J. T. ROTHROCK (*Pennsylvania Dept. Agr. Rpt. 1898, pt. 1, pp. 444–465*).—A review is given of the forestry conditions of the State and the losses occasioned by forest fires. For the year covered by this report it is stated that the loss due to forest fires would be reduced at least

40 per cent over the loss of the previous year. A brief review is given of forestry in other States, and the subject of tree pruning as related to forest conditions is discussed at considerable length.

Catalogue of the trees and shrubs in the arboretum and botanic garden at the Central Experimental Farm, W. Saunders and W. T. Macoun (*Canada Cent. Expt. Farm Bul. 2, 2. ser., pp. 88*).—A catalogue of the trees and shrubs grown under the auspices of the Central Experimental Farm is given in the hope that it may assist in the correct naming of varieties and be the means of bringing such useful and hardy species as are deserving of more general cultivation into greater prominence.

Forest trees and shrubs, P. Mouillefert (*Traité des arbres et arbrisseaux forestiers. Paris: Paul Klincksieck, 1898, pp. VIII+1403, pls. 195; rev. in Bul. Soc. Bot. France, 46 (1899), No. 1-2, pp. 60, 61*)—The author has described 2,450 kinds of trees and shrubs occurring in the forests of Europe, and especially in France. They include the useful and ornamental, whether cultivated or not.

The species and varieties are described in greater or lesser detail, and the country where they originated and their natural habitat given. Methods of culture, utilization, structure of wood, products of the trees, etc., are described.

The ash (Fraxinus excelsior), and its cultivation, J. Nisbet (*Trans. Roy. Scottish Arbor. Soc., 16 (1899), pt. 1, pp. 128-131*).—The value of this tree for its timber and as a forest tree is pointed out, and its leading characteristics as a tree are stated. It is said to demand considerable light and air and to make heavy requirements on the moisture and mineral matter of the soil. This tree has been chiefly grown in Great Britain as a hedge row tree, and if grown upon purely economical principles the proper position of the ash is that of a subordinate tree in woods consisting of other trees of somewhat slower growth. As a standard tree in copse the ash finds conditions well suited to its requirements, and here it attains its best development and highest market value.

Notes on the larch woods of Scotland, E. Nilson (*Trans. Roy. Scottish Arbor. Soc., 16 (1899), pt. 1, pp. 123-127*).—Comments are given on the condition of the larch woods of Scotland as observed by the author in a visit made to study the larch with special reference to Swedish conditions.

Mechanical tests of Ceylon timber, W. C. Unwin (*Indian Forester, 25 (1899), No. 10, pp. 411-415*).

Seed testing, C. D. Woods (*Maine Sta. Rpt. 1898, pp. 60-63*).—Tabulated results are given of the examination with regard to purity of 45 samples of red clover seed, 1 of white clover, 24 of alsike clover, 1 of peavine clover, 51 of timothy, 7 of redtop, 1 of orchard grass, 1 of Kentucky blue grass, and 3 of Hungarian grass. Seeds of 33 species of weeds were found in the 134 samples.

DISEASES OF PLANTS.

Cereal rusts of the United States, M. A. Carleton (*U. S. Dept. Agr., Division of Vegetable Physiology and Pathology Bul. 16, pp. 74, pls. 1, fig. 1*).—This bulletin contains in part the results of investigations by the author on the diseases of cereals. These studies have been carried on in the laboratory and field for a number of years, and include investigations into the life history of the fungi, in which some important facts relative to the breeding of rust-resisting varieties of cereals were obtained.

The several species of rusts affecting cereals in the United States are fully described and the distribution given, together with detailed statements of the results of observations and experiments to determine the rust resistance of numerous varieties of wheat and oats. Many inoculation, germination, and physiological experiments showed that, in addition to the commoner forms described, the cereal rusts have distinct specialized forms on various grasses. As none of these forms occur on cereals, they are of little economic importance.

From the author's conclusion it appears that at least 6, and possibly 7, distinct rusts affect the cereals of the United States, as follows: Orange leaf rust of wheat (*Puccinia rubigo-vera tritici*), orange leaf rust of rye (*P. secalis*), crown rust of oats (*P. coronata*), black stem rust of wheat and barley (*P. graminis tritici*), black stem rust of rye (*P. graminis secalis*), black stem rust of oats (*P. graminis avenæ*), and maize rust (*P. sorghi*). Of these the black stem rusts of wheat and oats are by far the most destructive, that occurring on maize being of slight importance.

The leaf rusts are evenly distributed over the United States wherever their hosts are grown. The stem rusts are most prevalent between the Allegheny Mountains and the ninety-fifth degree of west longitude north of the thirty-seventh degree of north latitude, and in portions of Texas and California. The leaf rusts and crown rusts are proportionately more important in the Atlantic and Southern Coast States.

The author believes that the damage to wheat and oats from rusts probably exceeds that caused by any other fungus or insect pest, and in some localities is greater than that due to all other enemies combined.

Concerning rust resistance of cereals, the author states that there is as yet little certainty, as little attention has been paid to testing varieties in this respect. A number of more or less resistant varieties of wheat and oats are mentioned, some of which seem to secure their immunity by their early ripening. The Durum and Poulard wheats are very resistant to the leaf rust, but are comparatively little grown in this country.

Experiments with uredospores show that the orange leaf rusts of wheat and rye do not transfer to hosts outside of the genera Triticum and Secale. On the other hand, the uredo stages winter over readily in this country, beginning first on selfsown grain and probably later transferring to the regular fall-sown crop. On this account volunteer wheat and rye should be rigidly excluded.

The crown rust of oats is not yet known to winter in its uredo form or to transfer to other hosts than to species of Avena. Later experiments, however, show that the æcidium of *Rhamnus lanceolata* infests oats, *Phalaris caroliniana* and *Arrhenatherum elatius*. The black stem rust of wheat is known to occur also on barley and *Hordeum jubatum*. So far it is not known to winter in the uredo stage. While it is not definitely determined, the author thinks that there is a distinct form of the black stem rusts occurring on rye in this country. The uredo of the black stem rust of oats is not known to winter in the United States, but it has been found alive very late in the autumn. The rust is very common on orchard grass and *Arrhenatherum elatius*, hence oats may be easily infected when grown in close proximity to these grasses, The maize rust occurs also on teosinte in this country, but does not winter its uredo.

An extensive bibliography concludes the bulletin.

Treatment of seed oats to prevent smut, J. A. TILLINGHAST (*Rhode Island Sta. Rpt. 1898, pp. 192–203*).—In continuation of his investigations the author treated 13 varieties of oats with the Jensen hot-water treatment as a smut preventive and also with Ceres Pulver to compare their relative efficiency in preventing oat smut. The different lots of oats were carefully weighed so as to secure equal amounts in each case. Those for the Jensen treatment were immersed in water at a temperature of 115° F. until thoroughly wet and warm, then in water at 132.5° for 10 minutes, after which they were thinly spread to dry. For the Ceres Pulver treatment the oats were put in small heaps, and the powder dissolved as per directions and sprinkled over them, turning and mixing them thoroughly so that each seed might become wet with the liquid, after which they were thinly spread to dry.

The oats were all sown April 28 and showed no decided difference in germination or growth except a tendency on the part of the treated seed to produce slightly taller plants. The yield of the different plats is tabulated, from which it appears that as a whole the Jensen treatment proved thoroughly efficient in preventing smut and also tended to increase the yield of both grain and straw. The Ceres Pulver treatment, while not entirely effective in destroying the smut spores, increased the average yield of grain and straw, and quite largely reduced the percentage of smut in most cases. The average gain due to treatment of all varieties was 17.81 per cent of grain and 12.75 per cent straw.

Notes are given on the growth and yield of the different varieties of oats used in the above trial and also their liability to rust and tendency to lodge.

Wilt disease of cotton, watermelon, and cowpea, E. F. SMITH (*U. S. Dept. Agr., Division of Vegetable Physiology and Pathology Bul. 17, pp. 72, pls. 10*).—The cause of the peculiar wilt of these plants has been under investigation for a number of years and has been referred by the author and others to a number of fungi. In the present bulletin the cause is attributed to a new genus of fungi to which the name Neocosmospora has been given, the species being *N. vasinfecta*, occurring on cotton and probably on okra, *N. vasinfecta tracheiphila* on cowpeas, and *N. vasinfecta nivea* parasitic on the watermelon.

While the parasitism of the fungus on cotton and cowpeas is not proved, the evidence seems to indicate that the fungus lives parasitically on these hosts. The biology of the fungus is described at considerable length. Its behavior on a large number of media is described as well as the different forms occurring in its life cycle. The host plants, as already indicated, are cotton, watermelons, cowpeas, and probably also okra. The fungus lives from year to year in the soil and is peculiarly a soil organism, always attacking the plant from the earth. The internal conidia occur in the vessels of the living plant throughout the season, and cause the disease known as blight or wilt. The external conidia are observed whenever plants have been killed by the internal fungus. The perithecia occur from August to November.

The geographical distribution of the fungus is sketched, showing that it is widely spread in the Southern States, and may be looked for from Texas to New Jersey. Except in one place in Arkansas, so far as known, it occurs only in the Atlantic and Gulf States.

The parasitism of the fungus and numerous infection experiments are described, from which it appears that successful infections of watermelons were abundant. On the cotton plant all inoculations have failed. Cross inoculations on the melon with the cotton fungus have been successful, as were cowpea inoculations on both melons and cotton. Attempts to inoculate a number of other plants were unsuccessful.

The gross symptoms in the watermelon are those shown in a rapidly transpiring plant supplied with insufficient moisture, resulting in the sudden wilting of the plant. The uniformity with which the fungus seeks out the vessels of the plant is very striking, and the water ducts are clogged to such an extent that they can not perform their necessary functions. The leaves of the cowpea usually become unjointed and fall off, leaving the green stems bare. In some cases they become yellow and fall off without showing any previous trace of the disease. In the case of the watermelon, the leaves do not become yellow when they fall off, but suddenly wilt and shrivel so that a large vine may lose all its foliage in from 24 to 48 hours. The cotton plant appears less susceptible and, as a rule, contains less of the fungus, often recovering partially so as to produce some fruit. The xylem of the deceased plant becomes brown, and in case of the translucent stem of the cowpea this stain shows through the green bark, giving an unusually dark appearance to the living stem.

While no cure is known for the disease in the case of the watermelon, which seems to be most attacked, it is recommended that fields already infested should not be planted with melons for a long series of years, but other crops grown in their stead. Infection can readily take place through the wash of lands already contaminated, as well as by dirt adhering to implements and to the feet of horses, cattle, etc. The vitality of the fungus is very great, and wilting melon vines should be collected and burned. Care must be taken not to introduce the fungus into the barnyard, and where there is reason to suspect the manure pile, commercial fertilizers should be used instead. A number of important steps in the life history of the fungus remain to be studied, but on account of the importance of the work, it is considered advisable to publish the information now at hand.

Treatment for gooseberry mildew, C. P. Close (*New York State Sta. Bul. 161, pp. 153–164, pls. 2, dgm. 1*).—In view of the destructive character of gooseberry mildew and its economic importance, experiments have been undertaken for treating the disease on a commercial scale. These investigations were begun in 1897 and were continued for three seasons. Two commercial plantations have been under experiment, and a preliminary report giving the result of the work in 1897 was given in Bulletin 133 (E. S. R., 9, p. 1061).

The fungicides used were Bordeaux mixture, lysol, and formalin, comparisons being made with potassium sulphid. The result of spraying, as shown by the percentage of mildewed fruit for three seasons, is tabulated, from which it appears that spraying the gooseberry bushes with a solution of potassium sulphid, 1 oz. to 2 gal. of water, at a cost of about three-tenths of 1 cent per bush for 7 applications, gave the best results.

On a second plantation experiments were tried on the relative value of winter and summer treatments. In the winter treatments copper sulphate, potassium sulphid, iron sulphate, copper carbonate, and soda-Bordeaux mixture were employed. The results obtained in one year's experiment indicate that there is no gain derived from winter treatment. The soda-Bordeaux and copper carbonate solutions gave slightly better results than potassium sulphid, but not great enough to be of any significance.

The recommendation given in Bulletin 133, viz, that spraying with potassium sulphid, 1 oz. to 2 or 3 gal. of water, is repeated. The spraying should be begun as soon as the buds are breaking and continued at intervals of about 10 days.

Chlorosis in fruit trees, R. L. CASTLE (*Gard. Chron.*, *3. ser.*, *25* (*1899*), *No. 652*, *p. 405; 26* (*1899*), *No. 653*, *p. 1*).—An account is given of experiments conducted in an orchard to prevent the chloritic condition of the various kinds of fruits. The soil of the orchard was a heavy marl, the proportion of chalk being large. The land was fertile and remarkably well suited to such crops as peas, beans, clover, cabbage, turnips, etc. The behavior of the fruit trees was remarkable. In 2 years from planting the foliage would nearly always become pale or whitish, the following year the branches would become weaker, and in the case of cherry and apricot, the affected portions quickly died. In most cases fruit buds were not produced, but when any fruits were borne by apple and pear trees they failed to develop satisfactorily.

Experiments were conducted to ascertain the effect of chemical fertilizers on this disease. The chief substances used were sodium nitrate; potassium nitrate, sulphate, and chlorid; kainit, ammonium sulphate, ground bone; and various grades of superphosphates. A mixture of potassium nitrate, superphosphate, and iron sulphate produced marked and highly satisfactory results. Apricots recovered, pears and apples became healthy, and fruit was developed and well ripened.

Further experiments are to be conducted to ascertain the best form of superphosphates to be used.

An outbreak of chrysanthemum rust, B. D. HALSTED (*New Jersey Stas. Circ.*, *Nov. 15*, *1899*).—The author reports the receipt of many complaints concerning a destructive disease of chrysanthemums which is due to a species of rust, probably *Puccinia hieracii.* When badly infested the chrysanthemum plant becomes dwarfed, the leaves small and brown on the under side. Later on, instead of the green color of healthy plants, there are small, stiff, leafless stems, ending in stunted heads that fail to open into marketable flowers.

This rust has been known in this country for but a few years, and experiments with remedial measures are quite limited. It is considered of prime importance that the stock used for propagation should be free from disease, and in all stages of growth, from the beginning, they should be sprayed weekly with Bordeaux mixture or other equally effective fungicides.

New diseases of the violet, P. H. DORSETT (*Amer. Florist, 15 (1899), No. 591, pp. 246–248, figs. 5*).—The author reports a rather serious trouble with violets due to nematodes. The leaves of the plant become yellowish and sickly looking, hard and brittle to the touch, and break with a pronounced cracking sound when bent between the fingers. In every instance the crown bud is wanting, and numerous runners and wiry shoots are put out, which show the plant's efforts to overcome the trouble, but the new growth is dwarfed and distorted. The plants have good roots, are free from root nematodes, and practically free from fungus diseases. Examination of the buds showed that the worms appear to live wholly in the buds and young growing parts of the plant. To prevent the introduction and spread of the pest, all stock should be carefully inspected before planting, and should the trouble appear all affected plants should be removed and burned, and, if possible, the soil in the beds removed to a depth of 6 or 8 inches.

A second disease described is that due to a wood fungus, *Merulius lacrymans.* This fungus is common on wood, producing dry rot, and is almost invariably found close to or in some portions of the woodwork in the beds in which the plants are grown. It was found that the fungus spreads from the wood in the beds to the adjacent plants by means of rather coarse, white mycelium, and, reaching the base of a plant, develops a rather thick, fleshy hymenium. At first this is snow white, but later becomes yellowish or grayish. The parts of the plant which are attacked rot and decay and the plant is killed before the fungus reaches maturity.

Strong Bordeaux mixture seems to have had little or no effect in checking the fungus, and it is cited that a healthy growth took place all over the surface of a cypress shingle that had been thoroughly saturated with a strong solution of copper sulphate. As the cause of this disease is a wood fungus, the construction of benches of brick or concrete would obviate the difficulty.

Hot water as a cure for mildew and as an insecticide, G. B. MALLETT (*Gard. Chron., 3. ser , 26 (1899), No. 661, pp. 166, 167*).—Numerous comments have been made on the value of hot water as a fungicide and insecticide. In the present article the author gives his experience in combating insects and fungi with this means. It is stated that grape mildew has been totally destroyed on vines by spraying them with water heated to 180° F. The leaves and berries were quite free from injury. He has also tested water heated to 160° upon roses for the prevention of rose mildew, with favorable results. A table is given of temperatures to which water should be heated when used as an insecticide against a number of the more common insect enemies. The temperatures range from 130 to 145° and are said to be safely used on a number of plants, such as apples, peaches, chrysanthemums, roses, tomatoes, asparagus, cabbage, etc.

A compilation of the animal and plant parasites of tropical plants, A. ZIMMERMANN (*Centbl. Bakt. u. Par., 2. Abt., 5 (1899), Nos. 15, pp. 550–555; 16–17, pp. 582–597*).—Lists are given of 122 animal and 50 plant parasites. An extensive bibliography is also given.

Plant diseases in Italy during 1898, SOLLA (*Ztschr. Pflanzenkrank., 9 (1899), No. 5, pp. 297–299*).—Brief notes are given on the more important plant diseases observed at the laboratory of Pavia during 1898.

The influence of parasites of beet seed on the growth of sugar beets, J. STOKLASA (*Centbl. Bakt. u. Par., 2. Abt., 5 (1899), No. 21, pp. 720–726*).—The investigations of the author show that parasitic animals and fungi on the seed balls of beets are often enabled to greatly weaken the plants or to destroy them entirely. On this account sugar beet seed should be treated with fungicides before planting and the early growth of the plantlets stimulated by the use of proper fertilizers.

Earcockle (Tylenchus scandens) (*Jour. Agr. and Ind., South Australia, 3 (1899), No. 5, pp. 431, 432, figs. 4*).—A brief account of the injury caused by this nematode in the heads of wheat. It is recommended that affected plants be pulled and destroyed.

A bacterial disease of beans, G. DELACROIX (*Compt. Rend. Acad. Sci. Paris, 129 (1899), No. 17, pp. 656–659*).—The author describes a bacterial disease of beans which in certain regions near Paris has proved to be of considerable importance. Microscopic examinations have shown the presence of large numbers of bacteria, the characters of which are given. The author states that the disease does not differ essentially from that recently described by E. F. Smith, of this Department (E. S. R., 9, p. 1058), and the probabilities are that the diseases are identical.

From the nature of the disease, it is stated that preventive treatment is not possible, and that attention must be given to the choice of seed and rotation of crops.

Two sclerotia diseases of potatoes, E. J. MCWEENEY (*Trans. British Mycol. Soc., 1897–98, p. 67*).

Yellow blight of the potato, T. JOHNSON (*Gard. Chron., 3. ser., 26 (1899), Nos. 676, p. 440; 677, p. 477*).—An account is given of investigations made by the author in the west of Ireland on the cause of this disease. Two fungi, *Sclerotinia sclerotiorum* and *Rhizoctonia solani*, were found present. The tubers and stems are affected, and the presence of the sclerotia of the Rhizoctonia in the tubers gives rise to the disease known as smallpox of potatoes.

Tea blights (*Gard. Chron., 3. ser., 26 (1899), No. 673, p. 379*).—Attention is called to two serious diseases of tea in Ceylon, namely, gray blight, due to *Pestalozzia gulpini*, and brown blight, caused by *Colletotrichum camelliæ*.

Contributions to the knowledge of Melampsorella caryophyllacearum, P. MAGNUS (*Ber. Deut. Bot. Gesell., 17 (1899), No. 9, pp. 337–343, pl. 1*).—Notes are given upon this fungus, and its relationship with other forms is discussed.

Septoria graminum, parasitic on leaves of wheat, L. MANGIN (*Bul. Soc. Mycol. France, 15 (1899), No. 2, pp. 108–126, figs. 6*).—The parasitism of this fungus is claimed to be established and much injury may be traced to its presence on the wheat.

Recent studies on the brown rusts of cereals, J. ERIKSSON (*Ann. Sci. Nat. Bot.,* *3. ser., 9 (1899), Nos. 2–4, pp. 241–256; 5–6, pp. 257–290, pls. 3).*—Gives an account of the author's recent investigations. Essentially the same as a previous publication (E. S. R., 11, p. 554).

The Puccinias of the type P. hieracii occurring on Compositæ, E. Jacky (*Ztschr. Pflanzenkrank., 9 (1899), Nos. 4, pp. 193–224; 5, pp. 263–295, figs. 19*).—Discusses the life history and specialization of the species of Puccinia of this type.

Notes on the Æcidia occurring on the Umbelliferæ, O. Juel (*Oefv. Kgl. Vet. Akad. Förhandl., 1899, No. 1, p. 5; abs. in Centbl. Bakt. u. Par., 2. Abt., 5 (1899), No. 20, pp. 689, 690*).

On the identity of Ustilago virens and U. oryzæ, J. Omori (*Bot. Mag. [Tokyo], 10 (1899), No. 110, pt. 2, pp. 29, 30; abs. in Bot. Centbl. Beihefte, 9 (1899), No. 1, p. 5*).—The author claims that these species are not identical as has been supposed by a number of other investigators.

The smuts of Cynodon dactylon and their distribution, P. Magnus (*Bul. Soc. Mycol. France, 15 (1899), No. 4, pp. 265–271, pl. 1*).—Notes are given on a number of species of Ustilago which are parasitic on *Cynodon dactylon*. Among those described are *U. paraguariensis, U. cynodontis*, and *U. dregeana*.

Sorghum blight, M. Radais (*Bul. Soc. Mycol. France, 15 (1899), No. 2, pp. 82–89*).—The author discusses the cause of sorghum blight and concludes that it is due, at least in part, to certain yeasts. Details are given of his experiments to isolate the yeasts, their characteristics are described, and the parasitism of the organism as shown by inoculation experiments is affirmed.

The fungus foes of fruits, B. D. Halsted (*Pennsylvania Dept. Agr. Rpt. 1898, pt. 1, pp. 482–501, figs. 11*).—Popular notes are given on a number of the more common parasitic diseases of the apple, pear, peach, plum, cherry, and grape, together with suggestions for their prevention. Notes are also given on a number of parasitic diseases of small fruits.

Notes on some of the mildews which occur on fruit trees (*Gartenflora, 49 (1900), No. 3, pp. 58–60, figs. 3*).

Gooseberry mildew held in check, F. H. Hall and C. P. Close (*New York State Sta. Bul. 161, popular ed., pp. 4, fig. 1*).—A popular edition of Bulletin 161 of the station (see p. 945).

Plant diseases due to Monilia, P. Sorauer (*Ztschr. Pflanzenkrank., 9 (1899), No. 4, pp. 225–235, pl. 1, fig. 1*).—An account of an attack on the apple is described.

Morphological variations of Monilia due to the influence of culture media, F. Guéguen (*Bul. Soc. Mycol. France, 15 (1899), No. 4, pp. 271–279, figs. 15*).—Describes a number of variations from normal growth that are attributed to the culture media in which the fungus was grown.

Concerning the Monilia disease, P. Sorauer (*Ber. Deut. Bot. Gesell., 17 (1899), No. 6, pp. 186–189*).—Discusses Monilia as a cause of disease in a number of plants.

A spot disease of olives in Portugal, V. d'Almeida (*Bul. Soc. Mycol. France, 15 (1899), No. 2, pp. 90–94, figs. 2*).—Describes a disease of olive fruits due to *Glœosporium olivarum*.

Concerning a sclerotium disease of the quince, H. C. Schellenberg (*Ber. Deut. Bot. Gesell., 17 (1899), No. 6, pp. 205–215, pl. 1*).

Bladder rust of Pinus strobus, C. B. Plowright (*Gard. Chron., 3. ser., 26 (1899), No. 657, p. 94*).—Gives an account of successful transfer of æcidiospores of *Peridermium strobi* to currant leaves on which the uredo stage was noted within 3 weeks. The experiments were made in 1893.

A disease of ornamental conifers, W. G. Smith (*Gard. Chron., 3. ser., 26 (1899), No. 672, p. 354*).—A disease of *Biota orientalis* due to *Pestalozzia funerea* is described. A number of other conifers are attacked and the most evident symptom of the disease is the withering of twigs and branches in otherwise healthy trees. The parasitism of the fungus is asserted, but more information regarding the method of infection is needed. Defective cultivation, unsuitable soil and climate are supposed to weaken the plant and assist in presenting the proper conditions for the disease.

On the determination of the fungi which attack forest trees in India, J. S. Gamble (*Indian Forester, 25* (*1899*), *No. 11, pp. 431–438*).—Notes are given on a number of parasitic and saprophytic fungi on Indian forest trees.

The parasites of the trees in the Cambre forest, P. Nypels (*Ann. Soc. Belge Micros., 24* (*1899*), *pp. 7–46, pls. 2*).

Cultures of Nectria, or parasitic tree canker, Bra (*Compt. Rend. Acad. Sci. Paris, 129* (*1899*), *No. 2, pp. 118–120*).—Notes are given on cultures made of *Nectria ditissima.* The character of the fungus as grown on nutrient media is described at some length, and analogies between the cultures of this parasite and that causing cancer of human beings are pointed out.

An injurious effect of Bordeaux mixture, R. Thiele (*Ztschr. Pflanzenkrank., 9* (*1899*), *No. 4, pp. 235, 236*).—Gives an account of injury to pear foliage and fruit, due to the use of too strong solutions.

Recent studies of Bordeaux mixture (*Ztschr. Pflanzenkrank., 9* (*1899*), *No. 5, pp. 317–320*).—Compiled information relating to the making and application of Bordeaux mixture.

ENTOMOLOGY.

Proceedings of the eleventh annual meeting of the Association of Economic Entomologists (*U. S. Dept. Agr., Division of Entomology Bul. 20, n. ser., pp. 111, figs. 4*).—At this meeting, held in Columbus, Ohio, August 18 and 19, 1899, the following papers were read:

The laisser faire philosophy applied to the insect problem, C. L. Marlatt (pp. 5–19).—This paper constitutes the annual address of the president of the association. The author states his belief to be that quarantine laws by State or National authority will ultimately prove ineffective in preventing the introduction or spread of injurious insects, and that no insect, when once introduced into a country, can be entirely exterminated by artificial means. He gives popular accounts of the more common theories which have been suggested to account for the increased activity of introduced insects. It is suggested that the economic entomologist should properly confine his efforts to discovery and application of more effective practical methods, rather than attempt to prevent the further distribution of injurious insects.

A remedy for gadflies: Porchinski's recent discovery in Russia, with some American observations, L. O. Howard (pp. 24–28).—An abstract of Porchinski's paper, which has been previously abstracted (E. S. R., 11, p. 653).

The present status of the caprifig experiments in California, L. O. Howard (pp. 28–35).—The author gives a brief account of the work of the fig insect, *Blastophaga grossorum*, in fertilizing the Smyrna fig of commerce. A number of unsuccessful attempts to introduce this insect into California have been made within the past few years. In the spring of 1899, the Division of Entomology imported some fig insects and they were successfully colonized in California. The insects have bred abundantly for one generation. These experiments have shown that it is possible to introduce the fig insect into California, and it remains now to determine whether the time of appearance of different broods of the insect will be so changed in California as to require other importations before making a permanent colonization of the fig insect.

The original home of the San José scale, L. O. Howard and C. L. Marlatt (pp. 36–39).—From a study of the literature of the subject and of cases of supposed original importation of the San José scale from Japan, the authors conclude that the evidence is not conclusive and that it would be quite as reasonable to suppose that the scale was carried from America to Japan as to suppose that it was originally imported into America from Japan.

Voluntary entomologic service in New York State, I. P. Felt (pp. 39–43).—The author reports the results of requesting reports from voluntary observers in different parts of the State. A number of these observers had reported regularly each week regarding the relative numbers of various injurious insects, and the author believes that such information will be of considerable value.

The Emory fumigator: A new method for handling hydrocyanic-acid gas in orchards, W. G. Johnson (pp. 43–45).—The use of duck tents for covering trees was considered too expensive for the average fruit grower, and a cheaper apparatus for fumigation was therefore devised. This apparatus is in the form of a box covered with rawhide paper, except the top, to which a hood of duck was adjusted. The box was lifted over the tree and the duck hood then adjusted to the top. In introducing the chemicals the box was slightly tilted. For larger trees it was found advisable to construct the box with hinges so that it could be opened and placed around the tree. This apparatus was about two-thirds as expensive as the ordinary duck tent used for fumigating purposes.

Insectary and office methods, F. M. Webster (pp. 46–52).—A general discussion of methods of collecting and rearing insects, and of management of this material after it is mounted, together with the keeping of records and mapping of distribution areas.

A probable remedy for the cranberry fireworm, A. H. Kirkland (pp. 53–55).—The larvæ of *Rhopobota vacciniana* causes considerable damage to the cranberry crop of Massachusetts. The larvæ of the first brood seldom cause much injury, while those of the second brood are often exceedingly destructive. Where the cranberry bogs can be flooded with water at the proper season for destroying the larvæ, this method is very effective, but in many cases it is impossible to use water in this way. Experiments were tried with arsenate of lead, which was used as a spray at the rate of 9 lbs. to 150 gal. of water. The first application was made in the early part of June. The second brood of caterpillars appeared during the first part of July, and a second application was made, the insecticide being used at the rate of 13½ lbs. to 150 gal. of water. Nearly all the larvæ were destroyed, and a great saving in the cranberry crop was the result of this method. It was found that three men with a good outfit could spray 8 acres of cranberry bog in 10 hours.

An interesting outbreak of chinch bug in northern Ohio, F. M. Webster (pp. 55, 56).—The chinch bug had been reported in 1886 from Huron County, Ohio. In the spring of 1899 this region was visited and was found to be more or less seriously infested with the short-winged form of the chinch bug.

Some insects of the year in Georgia, A. L. Quaintance (pp. 56–60).—Brief biological and economic notes upon the following insects: *Cerotoma trifurcata*, *Diabrotica vittata*, *Doryphora 10-lineata*, *Diabrotica 12-punctata*, *Allorhina nitida*, *Monocrepidius vespertinus*, *Ithycerus noveboracensis*, *Amphicerus bicaudatus*, *Scolytus rugulosus*, *Heliothis armiger*, *Diatræa saccharalis*, *Margaronia nitidalis*, *M. hyalinata*, *Plutella cruciferarum*, *Pieris rapæ*, *P. protodice*, *Plusia brassicæ*, *Pionea rimosalis*, *Aphis brassicæ*, *Spilosoma virginica*, *Phlegethontius celeus*, *Aphis gossypii*, *Murgantia histrionica*, *Melittia satyriniformis*, and *Anasa tristis*.

Notes of the year for New York, E. P. Felt (pp. 60–62).—A brief account of the following noxious insects: *Euvanessa antiopa*, *Systena frontalis*, *Clisiocampa disstria*, *Galerucella luteola*, *Crioceris 12-punctata*, and *Cicada septendecim*.

Miscellaneous entomological notes, W. G. Johnson (pp. 62–68).—The author gives a brief report of the depredations of the following injurious insects: *Nectarophora destructor*, *Crambus caliginosellus*, *Systena tæniata blanda*, *Myodocha serripes*, *Odontota dorsalis*, *Lygus pratensis*, *Pemphigus acerifolii*, *Psylla pyricola*, *Pteronus ribesii*, *Conotrachelus nenuphar*, *Anthonomus signatus*, *Haltica chalybea*, *Cecidomyia destructor*, *Notolophus leucostigma*, *Thyridopteryx ephemeræformis*, *Colopha ulmicola*, *Sphinx catalpæ*, *Galerucella luteola*, *Datana integerrima*, *Aphis gossypii*, *A. forbesi*, *A. prunicola*, *Diabrotica vittata*, *Aspidiotus perniciosus*, *Lecanium nigrofasciatum*, *Mytilaspis pomorum*, *Chionaspis furfurus*, *Tribolium confusum*, *Ephestia kuehniella*, *Tenebroides mauritanicus*, *Silvanus surinamensis*, *Murgantia histrionica*, *Crioceris asparagi*, *Plusia brassicæ*, *Pieris rapæ*, *Doryphora 10-lineata*, and *Epicauta vittata*.

Insects of the year in Ohio, F. M. Webster and C. W. Mally (pp. 68–73).—Brief notes on the following insects: *Diplosis tritici*, *Diabrotica longicornis*, *Thrips tabaci*, *Epicauta vittata*, *Melanoplus bivittatus*, *Fidia viticida*, *Macrodactylus subspinosus*, *Exartema permundana*, *E. fasciata*, *Oxyptilus tenuidactylus*, *Colaspis brunnea*, *Crioceris asparagi*, *Murgantia histrionica*, *Selandria vitis*, *Eudemis botrana*, *Hadena devastatrix*, *Lygus pratensis*, *Chramesus icoriæ*, *Gymnetron teter*, *Agromyza æneiventris*, and *Laverna gleditschiella*.

Temperature control of scale insects, C. L. Marlatt (pp. 73–76).—The author believes that either a cold damp climate or an excessively hot and dry climate is unfavorable to the development of scale insects, while a climate which presents a moderate amount of heat and moisture is most favorable for the growth and multiplication of these insects. It is suggested that possibly the scale covering is less dense in warm latitudes than in colder climates, and that consequently scale insects suffer more severely from a sudden fall in temperature in the former than in the latter regions.

An account of Aspidiotus ostreæformis, C. L. Marlatt (pp. 76–82, figs. 4).—This article is the same in its essential features as an article previously abstracted (E. S. R., 11, p. 274).

Fatal temperature for some coccids in Georgia, W. M. Scott (pp. 82–85).—The main facts of this article were previously published by the author in his report as State entomologist (E. S. R., 11, p. 368).

The destruction of hairy caterpillars by birds, E. H. Forbush (pp. 85–93).—Thirty-eight different observers have made reports upon the feeding habits of birds with reference to hairy caterpillars, and these reports are briefly summarized in the present paper. The author believes that actual observation of the feeding habits of birds in the field furnishes valuable evidence to supplement the results obtained in the study of the contents of birds' stomachs. The present paper is confined largely to observations made upon the gypsy moth, the brown-tail caterpillar, the tent caterpillar, and the forest tent caterpillar. The hairs of the brown-tail caterpillar are of the stinging sort and produce painful irritation when they come in contact with the hand. The caterpillars were eaten, however, in large numbers by various species of birds. A list of birds is given which includes those that have been actually observed feeding upon hairy caterpillars. The list includes 46 species.

The destructive pea louse, a new and important economic species of the genus Nectarophora, W. G. Johnson (pp. 94–98).—In May, 1899, the author's attention was first called to the destructive work of a plant louse which, upon investigation, proved to be a new species and which is called *Nectarophora destructor.* The insects attack the young pea-vines and multiply with such rapidity that the vines are often killed outright. The insects have also been found upon sweet peas. From the method which is usually adopted in cultivating peas, it is evident that the discovery of an effective remedy would be a difficult matter. It was found that a 15 to 30 per cent solution of kerosene and water destroyed the insects very thoroughly. Whale-oil soap and tobacco dust were also effective, but these remedies are expensive as applied to pea fields. The author found that a large proportion of the plant lice were destroyed by their insect enemies. Among these enemies the most important were the syrphus flies, the lady beetles, and lace-winged flies. In some instances the syrphus flies were present in very unusual numbers. No hymenopterous parasites were reared from the plant lice. A few of the plant lice died of what appeared to be a bacterial disease, but this matter is not yet determined.

The stalk worm: A new enemy to young tobacco, W. G. Johnson (pp. 99–102).—The larvæ of *Crambus caliginosellus* were found eating the stems of tobacco just at the surface of the ground or boring in the stems. Ordinarily but one larva was found in a single stem. The insects attacked corn and were very destructive to this crop, as well as to tobacco. The author believes that this insect is most likely to be found in tobacco fields which were previously sown to timothy or other grass, and recommends, therefore, that tobacco growers avoid planting tobacco upon grass or timothy sod.

An improvement in the manufacture of arsenate of lead, *A. H. Kirkland* (pp. 102, 103).—It was found that by using nitrate of lead in the place of acetate of lead for neutralizing the arsenate of soda, a larger percentage of arsenic was obtained and at a smaller cost.

Recent work against the gypsy moth, *E. H. Forbush* (pp. 104–107).—The State of Massachusetts has expended $1,155,000 in its warfare against the gypsy moth. During 1899 most attention was paid to burlapping, and about 2,500,000 trees were burlapped during the season. New colonies of the gypsy moth were discovered in Newton and Georgetown.

A destructive tan-bark beetle, *A. F. Burgess* (pp. 107, 108).—The larvæ of *Dinoderus substriatus* were found in great numbers in piles of tan bark which had been purchased in Nova Scotia in 1897. It was recommended that the tan bark be fumigated, but the expense was considered by the owners to be too great, and the infected bark was therefore ground up as quickly as possible.

Some insects of the year 1898, R. H. PETTIT (*Michigan Sta. Bul. 175, pp. 341–373, figs. 20*).—This bulletin contains brief economic notes on the following insects: *Schistocerca americana*, *Thrips tabaci*, *Brochymena annulata*, *Phoxoptera comptana*, *Depressaria persicæella*, *Clisiocampa disstria*, *Empretia stimulea*, *Aspidisca splendoriferella*, *Lithocolletis lucetiella*, *L. cincinnatiella*, *Pegomyia vicina*, *Cecidomyia destructor*, *Chrysomela suturalis*, *Magdalis armicollis*, *Scolytus rugulosus*, *Harpiphorus maculatus*, *Bruchophagus funebris*, *Neuroterus q-saltatorius*, and *Camponotus pennsylvanicus*.

The larvæ of *Depressaria persicæella* were found to feed to a considerable extent upon the leaves of peaches. They form loose nests by binding the peach leaves together with a fine silk thread. The larvæ were observed on July 3 and also on September 17, and are therefore probably two brooded. The insect was referred to Miss M. E. Murtfeldt, and she considered it a new species. Her description is included in the author's account. Among artificial remedies the author recommends spraying with Paris green, and destruction of the nests which are sufficiently conspicuous to render their detection easy.

The author found that the larvæ of *Aspidisca splendoriferella* in tying up their cases for the winter did not attach them to cherry leaves, but almost without exception to evergreen trees near at hand or to the twigs and bark of the cherry.

As a means for combating *Magdalis armicollis* the author recommends the use of trap poles of green elm to be set in the ground near the trees which one wishes to protect. These insects preferably lay their eggs in dying trees, and are led to deposit them in such trap poles and may thus be destroyed by burning the poles.

The author gives formulas and directions for the use of various insecticides, including whale-oil soap, pyrethrum, hellebore, arsenite of lead, Paris green, and carbon bisulphid. Some experiments were conducted in the treatment of beet seed with this latter substance. Four lots of seed were treated in different ways. Lot No. 1 was exposed for 24 hours to the action of the gas used at a rate of 2 dr. of liquid to a cubic foot of space. Lot 2 was exposed for 24 hours to an atmosphere saturated with the gas. Lot 3 was untreated and reserved as a check upon the others. Lot 4 was exposed for 48 hours to an atmosphere saturated with the gas. In lot 1, 93 per cent of the seeds germinated at the end of two weeks; in lot 2, 76 per cent germinated; in lot 3, which was the check, 93 per cent germinated; and in lot 4, 50 per cent germinated. Exposure to the gas at a rate of 2 dr. of liquid to the cubic foot of space seemed to accelerate the germination without injuring the seed.

Supplementary report of the zoologist, H. T. FERNALD (*Pennsylvania Dept. Agr. Rpt. 1898, pt. 1, pp. 373–443, figs. 19*).—Since very little literature on the economic entomology of Pennsylvania is available for the farmers of the State, the author has undertaken the preparation of brief popular accounts of a large number of injurious insects. Under the head of insects injurious to wheat, economic and biological notes are given on the following insects: The Hessian fly, the wheat midge, the wheat-stem maggot, the jointworm, the wheat-stem sawfly, the army worm, wireworms, grain aphis, Angoumois grain moth, and the granary weevil. These insects are for the most part figured, and brief descriptions are given of their appearance, habits, life history, and the remedies which have proved most effective against them.

Under the caption "cabbage insects" (p. 393), the author discusses the following insects from an economic standpoint: Cabbage worm, zebra caterpillar, the cabbage-root maggot, and the harlequin cabbage bug.

Under the head of "fruit insects" (p. 403), the following insects are discussed: The codling moth, the apple tree tent caterpillar, the cecropia moth, the round-headed apple-tree borer, peach-tree borer, peach-twig borer, and plum curculio.

The author has devoted some attention to household insects, and under this head (p. 418) has given an account of the following insects: The buffalo beetle, the black carpet beetle, clothes moths, cockroaches, and ants.

A discussion of a few miscellaneous insects is given in a separate section (p. 426), including economic accounts of the following species: The corn worm, the walking stick, the rose chafer, and the striped cucumber beetle.

Formulas are given (p. 435) for the preparation of some of the more common insecticides, such as Paris green, London purple, arsenate of lead, kerosene emulsion, whale-oil soap, Bordeaux mixture, and ammoniacal copper carbonate.

The author gives a brief discussion of the relationship between parasites and their hosts It is contended that parasites can not be depended upon to exterminate the host insects, but they may have the effect of checking their sudden unlimited multiplication. The Catalpa sphinx (*Ceratomia catalpæ*) is reported as having caused considerable damage to Catalpa trees near Media. The author recommends that this insect be controlled by the use of a Paris green spray upon such trees as are not too large and by the collection of the egg masses.

The pear and apple-leaf blister moth, F. V. THEOBALD (*Jour. Southeast Agr. Col., Wye, 1899, No. 8, pp. 21–31, figs. 5*).—The author gives a general account of the damages caused by this species, *Cemiostoma scitella.* The plants upon which the insect depredates are the sloe, hawthorn, apple, pear, and mountain ash. The insect seems to show a preference for the hawthorn, but is quite injurious to the apple and pear. The larvæ mine in the leaves of these trees and produce rather regular blotches, which are most conspicuous on the upper surface of the leaf. These blotches attain a diameter of one-half inch. The attack upon the leaves begins during the latter part of May, but is most active in July and August. The insect is apparently two brooded, the adult appearing at the end of April and again in June and July. The author describes and figures the various stages of this insect, and gives a brief account of its geographical distribution.

Paraffin and soap were sprayed upon the leaves without any effect. Arsenate of lead sprayed upon the leaves at about the time when the eggs are deposited seemed to have a beneficial effect.

The relation of honeybees to practical horticulture, W. R. LAZENBY (*Jour. Columbus Hort. Soc., 14 (1899), No. 3, pp. 149–154*).—In this paper the author records a number of observations upon the activity of bees in visiting the flowers of cultivated fruits. It was observed that the red raspberry was visited most frequently by bees and that other fruits were visited less frequently, as in the following series: Blackberry, plum, cherry, black-cap raspberry, apple, gooseberry, peach, pear, currant, and strawberry. Tables are presented, giving the weights of outgoing bees, honey-collecting bees, and pollen-laden bees.

Dickel's theory on the development of bees, A. THUMA (*České Listy Hospodářské, 7 (1899), No 7, pp. 261–265*).—A general discussion of the arguments for and against the parthenogenetic origin of drones.

Some harmful household insects, H. T. FERNALD (*Pennsylvania Dept. Agr. Bul. 48, pp. 13, figs. 2*).—This is a reprint from Pennsylvania Department of Agriculture Report for 1898, pt. 1, p. 118.

Notes on Ohio insects injurious to stored vegetable products, J. S. HINE (*Jour. Columbus Hort. Soc., 14 (1899), No. 3, pp. 120, 121*).—Brief notes on a number of insects which were observed to be injurious to stored vegetable products in Ohio.

The zonal distribution of Coleoptera, T. D. A. COCKERELL (*New Mexico Sta. Bul. 28, pp. 135–179*).—This bulletin is a continuation of Bulletin 24 of the station (E. S. R. 10, p. 324), and contains tables which show the distribution of the different families of Coleoptera, with the exception of the Cicindelidæ and Carabidæ. The region in which these insects were found is believed to belong to the Upper Sonoran Life Zone.

The insects of the year, F. L. HARVEY (*Maine Sta. Rpt. 1898, pp. 125–130*).—Brief notes on a number of common injurious insects.

Report of the entomologist, H. TRYON (*Queensland Dept. Agr. Rpt. 1898–99, pp.*

34–39).—In this report the author gives brief notes on the injurious insects of a great variety of economic plants. Good success is reported in connection with experiments in trapping the grub pest of sugar cane.

Farm pests, J. Fletcher (*Ottawa: S. E. Dawson, 1899, pp. 20*).—This pamphlet presents brief, popular accounts of the following insects: Tent caterpillar, San José scale, Rocky Mountain locust, wheat-stem maggot, cabbage-root maggot, pea moth, carrot rust fly, turnip aphis, gray fruit worm, and codling moth. The remedies which have been found effective in each case are recommended for use.

Insects, J. M. Southwick (*Rhode Island State Bd. Agr. Rpt. 1898, pp. 83–94, figs. 6*).—This paper contains notes on the potato beetle, cankerworm, codling moth, and tent caterpillar, with general directions for spraying and formulas for making Paris-green spray and kerosene emulsion.

A contribution to the study of mosquitoes, G. Noè (*Bul. Soc. Ent. Ital., 31 (1899), No. 1–4, pp. 235–262*).—This account contains descriptive and biological notes on the following species of mosquitoes: *Culex ficalbii, C. mimeticus, C. malariæ, C. pulchritarsis, C. albopunctatus,* and *C. nemorosus.*

Twenty species of Italian Culicidæ, E. Ficalbi (*Bul. Soc. Ent. Ital., 31 (1899), No. 1–4, pp. 46–234, figs. 89*).—In this article the author discusses methods of collecting and preserving mosquitoes and gives a general characterization of the family Culicidæ. Detailed notes by way of description and accounts of the habits and life history and economic importance of 20 species of Italian Culicidæ are given. These species belong to the genera Anopheles and Culex. The author also discusses the geographical distribution of the species. The following species are treated in this article: *Anopheles pseudopictus, A. superpictus, A. claviger, A. bifurcatus, Culex penicilliaris, C. ornatus, C. cantans, C. vexans, C. nemorosus, C. pulcritarsis, C. albopunctatus, C. annulatus, C. glaphyropterus, C. spathipalpis, C. richiardii, C. elegans, C. pipiens, C. modestus, C. impudicus,* and *C. hortensis.*

White grubs and the productiveness of meadows, R. Santrucek (*České Listy Hospodářské, 7 (1899), Nos. 5, pp. 168–170; 6, pp. 217, 218*)—The larvæ of a species of Melolontha were observed to attack *Bromus erecta, Aira cæspitosa,* Rumex, Scabiosa, Salvia, etc. The larvæ were parasitized by a species of Botrytis.

The clover-root mealy bug, R. H. Pettit (*Canad. Ent., 31 (1899), No. 10, pp. 279, 280, fig. 1*).—Notes on *Dactylopius trifolii.*

Some insects injurious to wheat, H. T. Fernald (*Pennsylvania Dept. Agr. Bul. 46, pp. 24, figs. 7*).—This is a reprint from Pennsylvania Department of Agriculture Report for 1898, pt. 1, p. 374.

Common cabbage insects, H. T. Fernald (*Pennsylvania Dept. Agr. Bul. 48, pp. 14, figs. 3*).—This is a reprint from Pennsylvania Department Agriculture Report 1898, pt. 1, p. 393.

Cranberry pests and how to combat them, J. S. Bishop (*Fruit Growers' Assoc. Nova Scotia Rpt. 1899, pp. 99–103*).—Notes on the fireworm, fruit worm, and the cranberry spanworm. Against the fireworm the author recommends the following remedies: Flooding the vines in June for 60 hours; spraying with tobacco, Paris green, or arsenate of lead for the fruit worm, spraying with Paris green just after the setting of the berries; for the spanworm, it is recommended that the vines be sprayed with Paris green or arsenate of lead.

Descriptions of Australian Curculionidæ with notes on previously described species, A. M. Lea (*Trans. Roy. Soc. South Australia, 23 (1899), No. 2, pp. 137–197*).

Some insects attacking fruit and fruit trees, H. T. Fernald (*Pennsylvania Dept. Agr. Bul. 47, pp. 19, figs. 5*).—A reprint from Pennsylvania Department of Agriculture Report for 1898, pt. 1, p. 403.

Notes on two new species of Aphids, G. B. Buckton (*Indian Mus. Notes, 4 (1899), No. 5, pp. 277, 278, pl. 1*).—*Chaitophorus maculatus* attacks *Medicago sativa* in India, and *Rhizobius jujubæ* is injurious to the roots of *Zigyphus jujuba.*

The pear-tree aphis (Lachnus pyri), G. B. Buckton and E. E. Green (*Indian Mus. Notes, 4 (1899), No. 5, pp. 274–276, pl. 1*).—This insect is reported as very injurious to pear trees in parts of Ceylon. Large quantities of honeydew are secreted by this species and the branches and trunks of the trees become covered with this substance. The insect appears to be viviparous. The attack is made on stems and branches, and the authors recommend the use of soap washes against the insect.

Some injurious scale insects, W. NEWELL (*Iowa Sta. Bul. 43, pp. 145–176, figs. 21*).—In this bulletin the author has given brief descriptions and an account of the life history, habits, and economic importance of the following insects: *Chionaspis furfurus, C. americana, C. ortholobis, C. salicis, C. pinifolii, Diaspis rosæ, Mytilaspis pomorum, Aspidiotus ancylus, A. forbesi, A. perniciosus, A. osborni, A. ficus, A. rapax, A. hederæ, Lecanium* spp., *Pulvinaria innumerabilis, Dactylopius longifilis*, and *D. destructor*.

Illustrations are given in the text of the majority of these insects. The author gives formulas and suggestions concerning the making and application of the insecticides which are in more common use against scale insects.

Three common orchard scales, J. B. SMITH (*New Jersey Stas. Bul. 140, pp. 16, figs. 9*).—This bulletin gives a popular account of the life history, habits, and means of controlling the oyster-shell bark-louse, scurvy scale, and San José scale. Among the remedies recommended against the San José scale, and against scale insects in general, may be mentioned whale-oil soap, kerosene, either diluted with water or in pure condition, and crude petroleum.

Chrysomphalus ficus and C. minor, P. MARCHAL (*Reprint from Bul. Soc. Ent. France, 1899, No. 15, pp. 3*).—These scale insects are reported by the author as having been recently introduced into Algeria and apparently established there.

The San José scale and other scale insects, H. T. FERNALD (*Pennsylvania Dept. Agr. Bul. 43, pp. 20, figs. 9*).—This bulletin contains a general account of the appearance, life history, food habits, distribution, and remedies to be adopted against the following insects: San José scale, oyster-shell bark-louse, scurvy scale, peach diaspis (*Diaspis lanatus*), *D. rosæ, Aspidiotus juglans-regiæ, A. ancylus*, and *Lecanium persicæ*.

American fruit and San José scale, K. POLAK (*České Listy Hospodářské, 6 (1898), No. 6, pp. 214–217, figs. 6*).—Brief notes on San José scale and a number of other related scales as occurring on American fruit.

The San José scale and related species, H. LOHMANN (*Schr. Naturw. Ver. Schleswig-Holstein, 11 (1898), No. 2, pp. 274–279*).—Brief notes on *Aspidiotus ostreæformis, Porphyrophora polonica, Coccus cacti, C. lacca*, etc.

Insect pests amendment act, 1898 (*Jour. Dept. Agr. West. Australia, 1899, Dec., pp. 15–17, figs. 3*).—Notes on the San José scale, fruit fly, and the inspection of packing cases.

The workings of the San José scale law, S. A. FORBES (*Trans. Illinois Hort. Soc., n. ser., 33 (1899), pp. 150–159*).—According to an Illinois law approved in April, 1899, the State entomologist is required to inspect all nurseries in the State once each year. A tolerably complete list of nurseries was secured and 4 inspectors have been placed in the field in different parts of the State. Considerable treatment of trees has been done both by spraying and fumigation. The author believes that the law is a good one and that its enforcement will be to the advantage of horticulture in the State.

An injurious caddice fly, F. L. HARVEY (*Maine Sta. Rpt. 1898, pp. 122–124*).—A caddice fly belonging to the genus Limnephilus is reported as having caused great damage to water lilies. The larvæ were rather thoroughly checked by handpicking and no further trouble has resulted from their attacks.

Notes on and descriptions of the male of Cœlostoma immane and of a new species of leaf-mining moth, J. G. O. TEPPER (*Trans. Roy. Soc. South Australia, 23 (1899), No. 2, pp. 278–280*).—*Nepticuea nigricansella* is reported as injuring the leaves of *Kennedya nigricans*.

Description of a new parasitic Tachinid fly from Ceylon, D. W. COQUILLETT (*Indian Mus. Notes, 4 (1899), No. 5, p. 279, pl. 1*).—*Exorista heterusiæ* is described as a parasite bred from *Heterusia cingala*.

Injurious millipedes, F. L. HARVEY (*Maine Sta. Rpt. 1898, pp. 118-121, pl. 1*).—*Polydesmus monilaris* and *Iulus hortensis* were observed during various stages of their development feeding upon radishes. Their attacks caused excrescences upon the exterior of the radishes. A number of other species of myriapods were observed in the greenhouses, but were not seen in the act of injuring radishes. Brief descriptions and biological notes are given concerning the 2 species mentioned, as well as of *Iulus virgatus*, *Paraiulus immaculatus*, and *Orthomorpha gracilis*. As remedies against these pests the author recommends hand picking. It is stated that more injury is done in subirrigated than in surface watered beds.

Combating the animal parasites of cultivated plants by means of their natural enemies, A. ZIMMERMANN (*Centbl. Bakt. u. Par., 2. Abt., 5 (1899), Nos. 23, pp. 801-809; 24, pp. 838-841*).—The author gives a review of the literature of the subject, together with a bibliography. The question is treated under the following heads: The natural enemies belonging to the animal kingdom, protection and artificial breeding of natural enemies, and importation of natural enemies from foreign countries. Special attention is given *Icerya purchasi*, *Aspidiotus perniciosus*, *Lecanium viride*, *Phylloxera vastatrix*, etc.

Annual report of the instructor in fruit culture, A. H. BENSON (*Queensland Dept. Agr. Rpt. 1898-99, pp. 39-44*).—The author reports on experiments in the use of hydrocyanic gas and the destruction of scale insects, and upon work in controlling the San José scale. In fighting this insect, the author painted the trees with sulphate of lime thickened with fine flour, and followed this treatment with a kerosene emulsion spray. A mixture of sulphid of soda and whale-oil soap also proved effective.

Methods for the protection of crops from insects and fungi, H. T. FERNALD (*Pennsylvania Dept. Agr. Bul. 49, p. 20*).—A brief outline of methods to be adopted in protecting field and garden crops from common insect and fungus diseases.

The timely plowing of stubbles and its influence upon certain diseases of cereals, M. HOLLRUNG (*Jahresber. Vers. Stat. Pflanzenschutz, Halle, 10 (1898), pp. 29-34*).—The author discusses the influence of this method in controlling diseases of cereals caused by *Oscinis frit*, *Cecidomyia destructor*, *Heterodera schachtii*, grain aphis, *Cephus pygmæus*, *Thrips cerealium*, and the fungi *Leptosphaeria herpotrichoides*, *Ophiobolus herpotrichus*, and species of Septoria.

The author concludes that, where it is possible, the stubble should be plowed under deeply immediately after the harvest.

Disinfection of grape stock against phylloxera (*Messager Agr., 4. ser., 10 (1899), No. 12, pp. 473, 474*).—Recommends immersion for five minutes in water at 53° C.

Recent developments in spraying, F. C. SEARS (*Fruit Growers' Assoc. Nova Scotia, Rpt. 1899, pp. 16-19*).—Notes on the preparation and application of insecticides and on the San José scale.

Modern methods of spraying, A. H. KIRKLAND (*Appendix Maine Bd. Agr. Rpt. 1898, pp. 69-79*).—A popular account of insecticides and spraying machines, with directions for treatment against some common injurious species of insects.

FOODS—ANIMAL PRODUCTION.

Experiments upon the digestibility of bread with men, C. D. WOODS and L. H. MERRILL (*Maine Sta. Rpt. 1898, pp. 173-195*).—In cooperation with this Department a number of experiments were made on the digestibility by man of white bread and milk, graham bread and milk, and entire-wheat bread and milk. In some of the experiments butter and sugar were also eaten. The experiments were conducted by the usual methods. The balance of income and outgo of nitrogen was also determined. (See following abstract.)

The digestibility of bread, C. D. WOODS and L. H. MERRILL (*Maine Sta. Rpt. 1898, pp. 196-207*).— Assuming that 98 per cent of the protein and carbohydrates, 99 per cent of the fat in milk, 99 per cent of the fat in butter, and 98 per cent of the carbohydrates in sugar is digestible, the authors calculate the digestibility of bread alone in the experiments noted in the article above, when the bread was consumed as part of a mixed diet. In these experiments the fuel value of the food and feces was determined and the heat of combustion of the urine was calculated. Making use of the data obtained, the percentage of energy of the food which was utilized in the body was calculated. The average results of all the experiments follow:

Digestibility of different kinds of bread by man

Kinds of food	Protein	Fat	Carbohydrates	Heats of combustion.
	Per cent	*Per cent*	*Per cent*	*Per cent*
White bread alone (average of 4 experiments)	82.0	70.7	98.4	92.2
White bread consumed with milk (average of 9 experiments)	88.3	66.6	98.2	94.8
Graham bread consumed with milk (average of 6 experiments)	77.0	58.1	92.4	88.0
Entire wheat bread consumed with milk (average of 5 experiments)	86.6	46.2	97.2	94.0

Skimmed milk vs. water in bread making, C. D. WOODS and L. H. MERRILL (*Maine Sta. Rpt. 1898, pp. 213–218*).—According to the authors skim milk is not usually appreciated in the household. Its comparatively high food value is pointed out, as well as the fact that it may be profitably used in making bread and other articles of diet. The composition of bread made with water and with skim milk was determined. The average results follow:

Composition of bread made with water and with skim milk.

Kind of bread	Water	Protein (N × 6.25)	Fat	Carbohydrates *a*	Carbohydrates *b*	Ash	Heats of combustion determined
	Per ct	*Per ct*	*Per ct*	*Per ct*	*Per ct*	*Per ct*	*Calories*
Water bread (average of 3 analyses)	39.44	8.93	1.07	49.69	50.48	.87	*c*2,694
Skim milk bread (average of 3 analyses)	37.97	9.98	.94	49.82	50.72	1.29	*c*1,710

a Estimated by difference assuming protein = N × 6.25
b Estimated by difference assuming protein = N × 5.7
c Average of two determinations.

Work of Repsteiner and Spirig on the digestibility of bread made with water and with skim milk is quoted in detail (E. S. R., 9, p. 981), and experiments on the digestibility of such breads in a pepsin solution are reported. It was found that on an average 94.7 per cent of the bread made with water was digestible and 94.21 per cent of that made with skim milk.

"Skimmed-milk bread contains more protein (muscle-forming food) than water bread. Skimmed-milk bread is as completely digested as water bread. The use of skimmed milk in bread making utilizes a valuable waste product of the dairy."

Preservatives in canned foods offered for sale in North Carolina, W. A. WITHERS and H. W. PRIMROSE (*North Carolina Sta. Bul.*

165, pp. 369–374).—The authors examined a number of samples of canned goods. Of the 11 samples of fruit, all were found to contain preservatives, but no mention of this fact was made on the label. Of the 20 samples of vegetables examined, 12 were found to contain preservatives, and the fact was not mentioned on the label. One sample each of clams, sausage, steak, potted tongue, and 2 samples each of oysters and salmon were examined, but no added preservative was found.

"As a summary of the whole it may be stated that no added preservative was found in the canned meats, but that 100 per cent of the canned fruits and 60 per cent of the canned vegetables contained salicylic acid, and that 18 per cent of the fruits and 10 per cent of the vegetables contained in addition sulphurous acid.

"Metals were not tested for in all the samples, but they were found in several of those where tests were made for them.

"In view of these facts the wisdom of the State legislation on the subject of food adulteration is apparent."

Dietary studies of negroes in eastern Virginia in 1897 and 1898, H. B. Frissell and Isabel Bevier (*U. S. Dept. Agr., Office of Experiment Stations Bul. 71, pp. 45, pls. 3*).

Dietary studies among the negroes in 1897, H. B. Frissell (pp. 1–25.)—Dietary studies were made with 12 negro families in the region bordering the Great Dismal Swamp. Most of the families had very limited means.

Dietary studies among the negroes in 1898, Isabel Bevier (pp. 27–45).—The author reports 7 dietary studies of negro families residing in Elizabeth City County. Some of the families had been brought to a great degree under the influence of Hampton Institute. Others had not had the benefit of such training. In some instances the resources of the families were very limited; in other cases the income was fairly large. The studies in this and the preceding section of the bulletin are discussed in some detail and the results compared with those obtained in other regions.

Cost, nutrients, and fuel value of food per man per day in dietary studies in Virginia.

	Cost.	Protein.	Fat.	Carbohydrates.	Fuel value.
	Cents.	*Grams.*	*Grams.*	*Grams*	*Calories.*
Dietary of a negro family near Franklin, Va	7	95	131	400	3,245
Do	6	76	141	372	3,145
Do	10	122	167	493	4,075
Do	8	159	189	575	4,770
Do	4	59	80	218	1,880
Do	6	55	160	314	3,000
Do	20	160	229	617	5,350
Do	5	70	103	343	2,650
Do	16	140	210	516	4,635
Do	11	117	225	608	5,065
Do	6	114	153	339	3,280
Do	13	117	169	410	3,730
Dietary of a negro family in Hampton, Va	21	183	135	506	3,875
Dietary of a negro family near Hampton, Va	15	104	163	346	3,360
Do	12	140	110	371	3,120
Dietary of a negro family in Hampton, Va	11	105	152	574	4,200
Do	9	74	194	484	4,090
Do	9	85	123	407	3,160
Dietary of a negro family near Hampton, Va	18	132	182	542	4,455
Average of 19 negro families in Virginia	11	109	159	444	3,745

"It would seem that, judging solely by the amount of nutrients, the negro families in Virginia were on the average more abundantly fed than those studied in Alabama. [E. S. R., 9, p. 160.] The fuel value of the food was, if anything, more than sufficient for their daily needs, although the majority of the people studied were at active exercise in the fields. The quantity of protein was as large as is found in the average diet of the ordinary white person.

"It is interesting to note that in the negro families who had come more or less under the influence of Tuskegee and Hampton Normal institutes the diet was more or less modified. . . . The diet of these families resembles quite closely that of the ordinary white family under similar conditions, both as regards variety of food materials and as regards the amounts of nutrients. . . .

"The range in the quantity of nutrients per man per day in the different studies is much larger than is ordinarily found among families in very much the same conditions as were the families studied. A possible reason for this large variation was suggested by the observed fact that when there was plenty of food on hand large quantities were consumed by the different families, after which, during a period of less plentiful food, much smaller amounts would be consumed, without apparent discomfort or ill results."

Effects of borax and boracic acid on the human system, O. LIEBREICH (*London: J. and A. Churchill, 1899, pp. 44, pls. 2*).—In this article, which is translated from the German, the author summarizes the history of borax and boric acid, the uses of these materials in medicine, quotes the results of a number of experiments with men and animals, and reports experiments in which dogs, guinea pigs, and rabbits were fed different quantities of boric acid, bicarbonate of soda, and saltpeter; metabolism experiments with dogs fed boric acid; tests of the influence of borax, carbonate of soda, and saltpeter on the ferments of saliva; of borax, boric acid, and saltpeter on pepsin and hydrochloric acid; and of these materials and carbonate of soda on extract of pancreas and on emulsine. The effect of boric acid and borax on the ciliary epithelium of a frog, and of boric acid, borax (water-free), soda (water-free), saltpeter, and common salt on the gastric and intestinal epithelium of dogs was also tested. According to the author the use of borax in medicine has been generally found to be satisfactory. The following statements were made in connection with feeding experiments with borax:

"A dog of 12.2 kg. weight was given meat food with 5 gm. borax dry per day. On the 16th day, the dog having meanwhile gained 1 kg., symptoms of violent intestinal inflammation set in and continued for 5 days. There was severe hemorrhage, appetite diminished, and howling and whining indicated a condition of pain. The dosing was continued during this period. On the 5th day of illness the dog recovered and seemed quite lively. For 70 days longer it was fed with 5 gm. borax daily, making a total of 450 gm. borax within 90 days. At the end of this period it had gained 3.4 kg. in weight. This experiment shows conclusively that borax in too great concentration or given in substance, as was here the case, is able to call forth intestinal symptoms, but that, in spite of the phenomena of intestinal irritation, no toxic influence on the entire organism could be observed, a fact supported primarily by the increase in weight from 12.2 kg. to 15.62 kg., i. e., 2.8 per cent. Other alkalis are not known to be so mild in their influence on the animal organism.

"Experiments on rabbits prove that even [relatively] larger doses of borax repeatedly given are well borne if the solid salt be not used. A rabbit of 2,400 gm.

received twice, on the first day and the fifth, the enormous dose of 5 gm. borax mixed with 20 cc. water. The œsophageal probang was used. There was not the slightest trace of any intestinal symptom.

"Guinea pigs were fed with large doses (0.5 gm.) of borax. They were given this dose in 60 cc. water in their food every day for 95 days. The animals remained in their normal condition throughout the whole period, and at its close they had increased in weight. . . .

"The primary result of all these experiments is that no determined aversion of animals against borax and boric acid exists. This is so far favorable, as opposition to feeding on unfamiliar substances is not infrequently met with from the start. Moreover, the experiments demonstrate the important fact of increase of weight. . . . [The] figures suffice to justify the assumption that the increase in weight can not be due to chance factors. Cage feeding [as in the experiments] is more favorable to the gain of weight than feeding in the open, and therefore it would be a mistake to imagine that feeding with boracic preparations exercises a special influence on such increase. But certainly the conclusion is justified that nutrition was not impaired by the admixture of the said preparations. . . . The facts brought out by these feeding experiments are important because poisonous qualities have been attributed to borax and boric acid, whilst here we have the proof to the contrary."

A metabolism experiment was made with a dog fed borax. A period of 10 days, in which 20 gm. of borax was consumed daily in addition to the other food, was preceded and followed by periods under normal conditions. The average income and outgo of nitrogen in the 3 periods was as follows:

Metabolism experiment with a dog fed borax.

	Duration.	Nitrogen.			Loss.
		In food.	In urine.	In feces.	
	Days	*Grams.*	*Grams.*	*Grams.*	*Grams.*
Preliminary period (ration without borax)	10	8.75	6.46	2.30	0.01
Borax period (same ration with borax)	10	8.75	5.65	8.13	.03
After period (ration without borax)	10	8.75	6.21	2.57	.03

This experiment, in the author's opinion, indicates that boric acid hinders putrefaction in the intestines.

The influence of boric acid on salivary, gastric, and pancreatic digestion is discussed in connection with the author's experiments.

"Though the feeding experiments have not brought out any specially unfavorable influence on digestion where the maximum doses were not exceeded, it seemed desirable, nevertheless, to examine borax and boric acid in their relation to the process of digestion, in order to find out whether possibly they might do harm. . . . The results demonstrate that borax lowers the sugar-forming power. . . .

"[As shown by the tests] neither borax nor boric acid exercises any disturbing influence on the transformation of starch into sugar. In this respect they resemble saltpeter, whilst, on the other hand, even ½ per cent of carbonate of soda has a decidedly deleterious action."

A microscopic examination of the mucous membrane of a frog showed, in the author's opinion, that borax and boric acid can not be considered injurious to the ciliary epithelium.

The experiments with dogs are held to have shown that boric acid had no injurious effect upon the gastro-intestinal epithelium. Borax, however, had a more powerful action. A 2 per cent solution caused a distinct increase of mucous secretion and disintegration of epithelial cells, *i. e.*, a deleterious effect.

> "The intestinal effect is milder. Here, too, the cells become translucent, but only distinctly so when a 3 per cent solution is reached. There is no disintegration of epithelia under a 5 per cent solution. . . .
>
> "On the intestine the action of soda is considerably more powerful than that of borax. At 1 per cent solution the deleterious action commences, cells in large quantity being disintegrated, whereas a 1 per cent borax solution leaves the intestine intact. In the case of saltpeter, the injurious effect on the stomach—and on the intestinal membrane, too—begins at the ½ per cent solution. It is worthy of note that even common salt in a 5 per cent solution exercises an inflammatory action on the gastro-intestinal mucous membrane. Here, too, we have the proof that no other effect than an alkaline one can be ascribed to borax, and that it has no specific injurious action of its own.
>
> "For the practical purposes of alimentation such strong solutions of borax and boric acid do not come in question; but even if such should be taken, the intestinal contents would be so much diluted by the gastro-intestinal juice, by the flow of gastric juice, bile, and intestinal secretion, that the concentration would fall below the limit value. . . .
>
> "Animal experiments demonstrate further that borax is easily excreted from the system and that no accumulation takes place. . . .
>
> "Now, though severest criticism of medical observations and experience won from experimental research justify the conclusion that borax and boric acid are innocuous as preservatives of food, this assertion of course can only be valid within certain limits, a restriction which, however, applies to all victuals and drugs; for we know that medicines, admixtures to food, and even aliments, when taken injudiciously or in excess, cease to be wholesome, and suddenly become injurious substances. And, moreover, if harm could be done by borax and boric acid used in the preservation of food, the immense quantities which have already been swallowed would have aroused the attention of medical men, particularly as boracic preservation is openly practiced (as may be seen by the butchers' trade journals), and has been unreluctantly accepted by the working class.
>
> "For the preservation of meat boric acid is used in quantities of ½ to ¾ per cent; of this a great part is lost in watering the meat, particularly in the smoking process, for instance, so that we may estimate ¼ per cent as the maximum amount which reaches the system. Experience has proved that 1.2 gm. of boric acid or borax, if taken in food daily, even for a considerable time, does not affect health injuriously. Even quantities twice as large have not proved injurious, scientific investigations having decisively demonstrated that these doses are far below the limit where deleterious action commences."

The publication includes an extended bibliography of the subject.

Oat hay harvested at different stages of maturity, J. M. BARTLETT (*Maine Sta. Rpt. 1898, pp. 93-96*).—The author points out that oats are not an ideal crop for hay. To secure the best hay the oats should be dried quickly in bright sunlight. The composition of oats cut when in bloom (July 27), when nearly all the kernels were in the milk stage (August 25), and when nearly all the grain was in the dough stage (August 12), was determined. In the latter case the tops of the stalks were green, but the lower portions showed signs of ripening; therefore, the composition of each portion of the stalk was also determined. The yield of the first cutting was 4,418.8 lbs. of dry matter per acre; of the second cutting, 5,218.3 lbs., and of the third cutting, 4,571 lbs. The composition of the oat hay of the different cuttings follows:

Composition of oat hay of different cuttings. (*a*)

	Water.	Protein.	Fat.	Fiber.	Nitrogen-free extract.	Ash.
Oat hay:	*Per cent.*	*Per cent.*	*Per ct.*	*Per cent.*	*Per cent.*	*Per cent.*
Cut when in bloom	26.46	7.25	1.85	26 99	31.90	5 55
Cut when grain was in milk	26.59	7.77	2.39	23.14	35.54	4.57
Cut when grain was in dough	16.30	6.47	2.84	26.58	42.00	5 21
Cut when part of heads were in bloom, part in milk	13.76	8.80	2.86	28.87	39.38	6.33
Cut when part of the heads were in milk, part in dough	13.28	6.59	3.30	29.45	41 13	6 25
First 8-inch section of bottom of stalk	9.80	2.50	1.72	39.23	40.58	6.17
Second 8-inch section of stalk	10.00	4.31	2.00	37.43	38 91	7.35
Top of plant	11.33	8.53	3.36	24.68	45.88	6 22

a These values are taken from p. 76 of the Maine Sta. Rpt. 1898.

Digestion experiments with sheep, J. M. BARTLETT (*Maine Sta. Rpt. 1898, pp. 79–92*).—In continuation of previous work (E. S. R., 10, p. 879), a number of experiments with sheep were made by the usual methods to learn the digestibility and value of H. O. Horse Feed, flax meal, oat hay cut in bloom, cut when the grain was in milk, when the grain was in dough, when the grain was partly in bloom and partly in milk, and when the grain was partly in milk and partly in the dough stage.

Oat hay was fed with the flax meal, and the digestibility of the flax meal alone was calculated. Taking into account the fuel value of the food consumed, of the feces, and the fuel value of the urea excreted, the available fuel value of each ration was calculated.

The average results of the experiments follow:

Summary of digestion coefficients obtained in experiments with sheep.

	Dry matter.	Organic matter.	Protein	Fat.	Nitrogen-free extract.	Fiber.	Ash	Available energy of food.
Oat hay	*Per ct.*	*Per ct.*	*Per ct*	*Per ct.*	*Per ct*	*Per ct.*	*Per ct*	*Per ct.*
Cut in bloom (average of 4 sheep)	54.3	53 7	53 5	48.3	51.2	59 9	48.6	52.55
Cut in milk (average of 4 sheep)	52.8	54 0	58.6	62.3	55 0	50 3	34.1	52.1
Cut in dough (average of 4 sheep)	53 8	54.8	44.7	64.5	59.1	49 4	41 0	52.5
Cut in bloom and milk (average of 2 sheep)	55 9	57.3	63.6	63.3	57.5	54.5	37.7	56.15
Cut in milk and dough (average of 2 sheep)	55 2	56.6	47.6	71.6	59.7	52.5	38 2	56.36
H. O. Horse Feed (average of 2 sheep)	75.7	77.6	75.7	80.8	83.0	....	....	....
Flax meal (average of 4 sheep)	80 6	82.4	82.4	95 3	87.4	....	....	67.98

An experiment in grazing a corn and cowpea field with steers, R. L. BENNETT (*Arkansas Sta. Bul. 58, pp. 97–100*).—The profit of grazing steers on a corn and cowpea field (after the corn was pulled), supplementing this with as much cotton seed as the animals require, was tested with 5 steers on a field of 5 acres. The corn yielded 25½ bu-to the acre, which was regarded as hardly an average crop. The cowpeas made more than an average growth of vines but less than an average crop of peas. None of the latter were picked.

The steers required 65 days to consume all the food on the 5 acres. They were allowed access to only one-third of the field at a time. The cotton seed was always accessible and was consumed *ad libitum*. During the first 30 days of the test, while the pea vines were yet green and peas were accessible, the steers ate very little cotton seed.

At the beginning of the test the 5 steers weighed 3,858 lbs. The average daily gain was 2 lbs. per steer. The average amount of cotton seed consumed per steer during the whole test was 250 lbs. Rating cotton seed at $6 per ton, and making suitable allowance for the cowpeas planted, the cultivation of the crop, and the labor of feeding the steers, the cost of a pound of gain was calculated to be 1.6 cts.

"In estimating the cost of the grazing, the cotton seed and cowpeas are charged to the feeding, but it is reasonable to suppose they will, as manure scattered over the soil, increase the yield of the succeeding crop more than their cost. The advantages of feeding cotton seed to the steers instead of corn are cheapness as a food and greater value as a fertilizer. It was estimated that the steers grazed the three lots of the field about as follows: [On the first plat, one third of the field,] all the pea vines, husks, fodder, and about one-fourth of the stalks were eaten. [On the second and third plats, each one-third of the field,] frost having fallen October 22, the steers ate about two-thirds of the pea vines, all the husks and fodder, but scarcely any of the stalks. The results of the grazing of this field indicate that the corn should be gathered and the animals turned to grazing as early as possible before frost."

Raising calves for profitable beef production, C. H. ELMENDORF (*Nebraska Sta. Press Bul. 11, pp. 8, figs. 2*).—The cost of raising calves dropped by 6 cows showing Shorthorn or Hereford blood was recorded. The cows cost $30 per head. All the calves were dropped after February 1, 1898. They were allowed to run with their dams from birth until the latter part of August. Two of them were then stabled and fed 6 lbs. of alfalfa hay and 1 lb. of a mixed grain ration consisting of ground oats and corn, bran, and oil meal, 4:4:1. The oats and corn were ground together in the proportion of 1:2. In the latter part of October all the calves were weaned and fed alfalfa with ground oats and corn, 1:2. The ration was gradually increased to 20 lbs of alfalfa and 4 lbs. of grain per head per day. The latter part of January, 1899, a pound of bran was added to the daily ration. The cows were fed 1 year and the calves until April 1, 1899. In discussing the financial returns, bran was rated at $9 and alfalfa at $3 per ton; oil meal at $1.45 per hundredweight; and corn and oats each at 25 cts. per bushel. The total cost of production, including keeping the cows, is estimated at $70.09. Making suitable allowance for cost of feed and interest on the value of the cows, the author calculates that there was a profit of $10.96 per head, the calves being worth $4.50 per hundred pounds.

"From statement of weights and gains it will be noted that the total gain for 160 days, October 22 to April 1, was 1,405 lbs., or an average daily gain of 1.46 lbs. per head per day. For the 95 days, October 22 to January 25, the gain was 745 lbs., or an average daily gain per head of practically 1.3 lbs., while for 65 days, January 25 to April 1, the gain was 660 lbs., or practically 1.7 lbs. per head per day. . . . The average daily feed ration for 160 days cost, say, 2.64 cts. per day, with compensating average gain of 1.46 lbs. per head per day, which, at $4.50 per cwt., would be worth 6.57 cts., practically a profit of 150 per cent on cost of feed consumed."

Experiments in pig feeding, C. W. BURKETT (*New Hampshire Sta. Bul. 66, pp. 111–122, dgms. 3*).—Tests were made of the comparative value for pigs of a number of feeding stuffs in combination with skim milk.

Pumpkins, cooked and uncooked; apples and pumpkins; corn meal and bran; corn meal (pp. 111–116).—These feeding stuffs were compared with 6 lots, each made up of 3 pigs. All the lots were fed skim milk. In addition lot 1 was fed corn meal and cooked pumpkins; lot 2, corn meal and raw pumpkins; lot 3, raw pumpkins; lot 4, corn meal; lot 5, cooked pumpkins and apples, 1:1; lot 6, corn meal and bran, 1:1. The pumpkins were raised at the station, at a cost of 40 cts. per ton. The apples were common cider apples or windfalls, valued at 10 cts. per bushel. Corn meal was rated at $16 and bran at $17 per ton and skim milk at 20 cts. per hundred pounds. The average results of the test, which covered 25 days, are shown in the following table:

Results of feeding pigs pumpkins, apples, corn meal, and bran with skim milk.

	Weight at beginning.	Average daily gain.	Feed consumed per pound of gain.				Cost per pound of gain.
			Milk	Grain.	Pumpkins.	Pumpkins and apples.	
	Pounds.	*Pounds.*	*Pounds*	*Pounds.*	*Pounds.*	*Pounds.*	*Cents.*
Lot 1 (skim milk, corn meal, cooked pumpkins)	416	2.21	3.79	3.09	4.47	....	3 32
Lot 2 (skim milk, corn meal, raw pumpkins)	426	2.26	3.70	3.02	7 93	....	3.31
Lot 3 (skim milk, raw pumpkins)	423	1.12	7.50	....	45.20	....	2.39
Lot 4 (skim milk corn meal)	418	1 97	4.92	3 77	....	....	3.81
Lot 5 (skim milk and cooked pumpkins and apples	420	1.54	5.45	....	....	32.40	4.64
Lot 6 (skim milk, corn meal, bran)	428	2 16	3.88	3.92	....	....	4.01

"Cooking pumpkins does not increase their feeding value. When pumpkins are available for pig feeding they can be fed most economically in connection with corn meal. While raw pumpkins fed in connection with skim milk produced a pound of gain at small cost, so few pounds were produced it is advisable to feed corn meal with them. Apples, even at the low price of 10 cts. per bushel, are not an economical food for pigs. Bran is not desirable as a food for pigs, even if fed with corn meal."

Feeding value of bran, fermented and unfermented; bran and corn meal; corn meal in pig feeding (pp. 116–120).—Since it is sometimes said that fermenting bran improves its feeding quality, the point was tested and the fermented and unfermented material compared with a mixture of bran and corn meal and bran alone, using 4 lots of 3 Chester White Berkshire pigs. The test covered 2 periods of 99 and 21 days. During the whole test all the lots were fed skim milk. In addition, lot 1 was fed fermented bran during the first period, lot 2 unfermented bran, lot

3 bran and corn meal, and lot 4 corn meal. During the second period all the lots were fed corn meal. "In fermenting the bran, it was steamed in a barrel and left for 10 days before it was used. By this time it was quite sour." The following table summarizes the results of the test, the financial statement being based on the same values as in the preceding test:

Comparative value of fermented and unfermented bran and corn meal for pigs.

	Weight at beginning.	Average daily gain.		Feed consumed per pound of gain, whole test.		Cost of food per pound of gain, whole period.
		First period.	Second period.	Grain.	Skim milk.	
	Pounds.	*Pounds*	*Pounds*	*Pounds*	*Pounds.*	*Cents.*
Lot 1 (fermented bran)	141	0.61	1.44	3.04	8.81	3.80
Lot 2 (unfermented bran)	144	.70	1.24	3.21	8.72	3,92
Lot 3 (bran and corn meal)	143	.76	.88	3.27	9.26	3.43
Lot 4 (corn meal)	141	1.08	1.38	2.84	6.89	3.32

"There is but little gained in fermenting bran for pig feeding. Bran is undesirable as a feeding stuff for pigs, fed either alone or in combination with corn meal."

Ear corn compared with ground corn and cob for pigs (pp. 120–122).—The economy of grinding corn was tested with 2 lots of 6 pigs each. Lot 1 was fed corn on the ear; lot 2, ground corn and cob, the same corn being used in each case. Both lots were also fed skim milk. Lot 1 weighed 152 lbs. at the beginning of the test, which covered 4 weeks, and lot 2, 148 lbs. The average daily gain of the 2 lots was 0.81 and 0.87 lb., respectively. Lot 1 required 8.92 lbs. of skim milk and 3.33 lbs. of grain; and lot 2, 8.55 lbs. of skim milk and 3.19 lbs. of grain per pound of gain.

Corn on the ear was rated at $16 per ton and the cost of grinding at 12 cts. per hundred pounds. In the author's opinion, the slightly better gains made on the ground material did not cover the cost of grinding.

Ground corn and cob has a slightly better feeding value than corn on the ear. For practical purposes it is more economical to feed corn on the ear rather than hauling to the mill and grinding for feed.

Experiments in pork production, J. H. GRISDALE (*Canada Cent. Expt. Farm Bul. 33, pp. 35, pl. 1, figs. 7*).—This bulletin summarizes the experiments in pig feeding conducted at the Central Experimental Farm from 1890 to the present time, the following general statements being drawn:

"It will not pay to cook feed for swine where economy of pork production is the sole consideration. There is a gradual increase in the quantity of feed consumed for every pound of gain in live weight after the average live weight exceeds 100 lbs. The most economical time to slaughter swine is when they weigh from 175 to 200 lbs. The greatest and most economical gains are made when the swine are able to eat the most feed in proportion to their weight.

"Frozen wheat may be used as a profitable feed for swine. Skim milk adds most materially to the value of a grain ration, and 100 lbs. mixed grains equal about 700 lbs. skim milk. The relative value of skim milk in any ration varies with the amount fed, the poorest returns per pound fed being obtained when the proportion of skim milk to the total food is the greatest. The average dressed weight of swine is about 76.44 per cent of the fasted weight.

"Skim milk is a most valuable adjunct to the grain ration when hard flesh is desired.

"Type of animals fed influences character of meat more than breed, *i. e.*, the fact of an animal being a Yorkshire or a Tamworth will not insure a good bacon carcass, but they must also be of a rangy type and fed in a certain way. Feeding mixed meal (barley, peas, and oats) with milk usually insures firm meat. The greatest gains from a given amount of grain appear to be made when it is ground and soaked for 24 hours. Part of the grain fed whole is frequently voided before being digested. Mixed grains are more economical than grains fed pure. Pigs whose rations are limited make, on the whole, more economical gains than pigs that are rushed. Maturity or ripeness of the animal affects the quality of the flesh."

The number of hens that can be profitably kept in one pen, G. M. GOWELL (*Maine Sta. Rpt. 1898, pp. 144–147*).—Records were kept of the number of eggs produced by 8 lots of Brahma pullets and 7 lots of Barred Plymouth Rock pullets. Four of these lots contained 15 pullets each; four, 20; four, 25; and three, 30. The several lots were kept in pens 10 by 16 ft. Each pen had the same amount of window surface. The roosts, gravel, bone, and water dishes and nests were arranged alike in all pens, and each had the same yard space. The test covered 6 months, beginning with November. The pullets in one of the lots were hatched April 16; all the others were hatched May 2. The profits were estimated on eggs at 2 cts. each and the food consumed per fowl at 50 cts. The average results of the test follow:

Average number of eggs and estimated net profit from hens in flocks of different sizes.

	Number of hens in each pen	Number of eggs produced per hen.	Number of eggs produced per pen	Value of eggs produced per pen	Value of food per pen	Income per pen less cost of food
Lots 1, 5, 9, and 13	*a* 15	65.1	976	$19.52	$7.50	$12.02
Lots 2, 6, 10 and 14	20	60.4	1,208	24.16	10.00	14.16
Lots 3, 7, 11, and 15	25	51.4	1,284	25.64	12.50	13.14
Lots 4, 8, and 12	30	40.1	1,203	24.06	15.00	9.06

a The April hatched hens in Pen 1 are not included in this table

"It will be observed that pens containing 20 birds did not give as much profit per bird as did pens of 15 birds, but the pens containing 20 birds gave a greater total net profit per pen than did those containing any greater or less number of birds. Pens with 25 birds gave slightly greater net returns than did the 15-bird pens. The pens that had 30 birds each gave very much less net returns than did any of the others. These tests show that when 20 birds were confined on 160 ft. of floor space they yielded more profit than did 15 birds when kept in a similar room. This is a matter of considerable consequence, for the cost of buildings, for the proper housing of birds during the cold winters of our climate is the greatest item of expense to which the poultryman is subjected."

A nest box for keeping individual egg records, G. M. GOWELL (*Maine Sta. Rpt. 1898, pp. 141–143, pl. 1, fig. 1*).—The author describes a nest box so arranged that the hen when entering the nest releases a door, which closes and fastens automatically. After laying, the hen is liberated by an attendant, and by numbering the egg to correspond with the number of the hen an accurate record may be kept of the egg production of individual hens. These nest boxes are being used in experiments undertaken with the object of breeding families which shall excel as egg producers.

Daily bread, DE MONTAIGNAC (*Le pain quotidien. Mont Luçon: Trillers, 1899; rev. in Jour. Hyg., 24 (1899), No. 1205, p. 348*).—The author discusses white bread and bread from different kinds of flour.

Shall bread be made in the home? FLORENCE R. FAXON (*New England Kitchen Mag., 12 (1899), No. 3, pp. 83-88*).—On the basis of statistics gathered in Quincy, Mass., the economy of home bread making is discussed. Methods of bread making are described, and the sanitary condition of the bakeries is also spoken of.

The advantages of cereals as food plants, F. L. SARGENT (*New England Kitchen Mag., 11 (1899), No. 6, pp. 219, 220*).—An extract from the author's book entitled "Corn Plants" (E. S. R., 11, p. 423).

Distilled water as a beverage (*New England Kitchen Mag., 11 (1899), No. 4, pp. 156, 157*).—The advantages and disadvantages of distilled water as a beverage are discussed.

Coffee and coffee substitutes, C. B. COCHRAN (*Rpt. Pennsylvania State Dept. Agr. 1898, pt. 1, pp. 548-557*).—An examination of 24 samples of ground coffee is reported, 19 of which were found to be adulterated. The adulterants were chicory or the roots of other plants showing similar microscopic structure, peas, pea skins, coffee hulls, wheat, or other cereals.

The substitutes for coffee (*Rpt. Pennsylvania State Dept. Agr. 1898, pt. 1, pp. 78-80*).—A brief report of the examination by C. B. Cochran of a number of samples of coffee substitutes.

Coffee and its adulterants (*Rpt. Pennsylvania State Dept. Agr. 1898, pt. 1, pp. 75-77*).—A general article quoting the Pennsylvania Pure Food law on the subject.

Chocolate and cocoa (*Rpt. Pennsylvania State Dept. Agr. 1898, pt. 1, pp. 90-92*).—The composition of cocoa beans is quoted and the manufacture and adulteration of chocolate discussed.

Cocoas and chocolates, C. B. COCHRAN (*Rpt. Pennsylvania State Dept. Agr. 1898, pt. 1, pp. 652-662*).—An examination of 41 samples of cocoas and chocolates is reported. The determinations include foreign starches, cane sugar, reducing sugar, fat, ash, acid equivalent of ash, and refraction number of fat.

Foods which protect others, O. FOLLOWELL (*Les aliments d'epargne. Paris: Jovet & Bayer, 1899; rev. in Jour. Hyg, 24 (1899), No. 1212, p. 404*).—Under this heading the author includes tea, coffee, kola, maté, etc. The use of these materials is discussed.

Beer, wine, and malt extracts (*Rpt. Pennsylvania State Dept. Agr. 1898, pt. 1, pp. 81-86*).—The examination of a number of samples of beers, wines, and malt extracts is reported.

Soda-water sirups, F. T. ASCHMAN (*Rpt. Pennsylvania State Dept. Agr. 1898, pt. 1, pp. 533-536*).—A number of samples of soda-water sirups were examined with a view to the detection of preservatives.

Mustard and its adulteration (*Rpt. Pennsylvania State Dept. Agr. 1898, pt. 1, p. 89*).—The article quotes the composition of mustard and gives brief directions for detecting its adulteration.

Pepper and its adulteration (*Rpt. Pennsylvania State Dept. Agr. 1898, pt. 1, pp. 89, 90*).—The composition of pepper is quoted and its principal adulterants noted.

The adulteration of foods, C. D. WOODS (*Rpt. Maine Bd. Agr. 1898, pp. 35-46*).—An address at the annual meeting of the Maine Board of Agriculture. Adulteration is defined, common methods of adulteration described, and the legislation on food adulteration of a number of States is cited.

Food adulteration in North Carolina, W. A. WITHERS (*North Carolina Sta. Spec. Bul. 53, pp. 19*).—A popular summary of bulletins of the station on the adulteration of vinegar, coffee and tea, baking powders, flour, and canned goods (E. S. R., 10, pp. 1077, 1089; 11, pp. 278, 960). The North Carolina legislation regarding food adulteration is noted.

Preliminary report on dietaries for hospitals for the insane, W. O. ATWATER (*New York State Lunacy Com. Rept. 1897–98, I, pp. 31–200*).—This article discusses food and its functions, dietaries with special reference to hospitals for the insane, and gives a number of tables showing the quantities of different food materials which are equal in nutritive value to a food chosen as a standard. On the basis of foods supplied, the nutrients in the daily dietary of 10 State hospitals for the insane were computed. From the statistics obtained, recommendations for modifying the diet were made.

The food value of alcohol, P. BJERRE (*Skand. Arch. Physiol., 9 (1899), No. 6, pp. 333–335*).—A number of experiments are reported in which alcohol formed part of the diet, and the conclusion is drawn that alcohol is a nutrient, since it supplies the body with energy and may take the place of other foods in the diet.

A new method of measuring the respired air and its oxygen content in experiments with man, U. SCHATERNIHON (*Physiologiste Russe, 1 (1899), No. 12–14, pp. 194–204, figs. 9, pl. 1*).—A comparatively simple apparatus is described of the type in which a sort of mask is worn over the nose and mouth.

Analyses of fodders and feeding stuffs, C. D. WOODS (*Maine Sta. Rpt. 1898, pp. 75–78*).—The composition of a number of fodders and feeding stuffs analyzed in connection with the station work is reported. The analyses included bran, corn meal, cotton-seed meal, Chicago gluten meal, king gluten meal, Blatchford's calf meal, Cleveland flax meal, linseed meal, Buffalo gluten feed, diamond gluten feed, gluten feed, mixed feed, Quaker oat feed, H. O. poultry feed, H. O. scratching feed for poultry, H. O. dairy feed, H. O. standard horse feed, H. O. horse feed, H. O. Scotch oat feed, H. O. "Victor" corn, oat, and barley chop, H. O. "De Fi" chop, H. O. oat bran, buckwheat middlings, wheat middlings, oat middlings, oat bran, oatena, ground oat hulls, grain hulls, corn germs, ground corn, oat hay (different cuttings and parts of stalk), corn silage, and hay.

Feeding-stuff inspection, C. D. WOODS (*Maine Sta. Rpt. 1898, pp. 48–60*).—This covers the same ground as two recent bulletins of the station (E. S. R., 10, pp. 381, 1089).

Feeding stuffs, J. A. VOELCKER (*Jour. Roy. Agr. Soc. England, 3. ser., 10 (1899), No. 4, pp. 661–663*).—This article reports the examination of linseed cake, cotton-seed cake, compound cakes, gluten refuse, and coffee husks.

The newer stock foods (*Rpt. Pennsylvania State Dept. Agr. 1898, pt. 1, pp. 70–72*).—Descriptions of gluten feed, Atlas meal, dried brewers' grains, malt sprouts, cerealine feed, hominy feed or chop, oat feed, and corn and oat chop.

The estimation of the products of peptic digestion, J. EFFRONT (*Chem. Ztg., 23 (1899), Nos. 75, pp. 770, 771; 76, pp. 783, 784*).—The determinations recommended include (1) total nitrogen, (2) total albuminoid nitrogen, (3) syntonine, (4) proteoses, and (5) peptones. Laboratory directions are given and methods are discussed.

Behavior and effect of sugars in the body, P. ALBERTONI (*Mem. Roy. Accad. Sci. Ist., Bologna, 5. ser., 8 (1899); Ann. Farm. e Chim., 1899, I, p. 245; Chem. Ztg., 23 (1899), No. 88, Repert., p. 316*).—Experiments with milk sugar and other sugars are reported. These were made on a dog by Hammerschlag's method.

The value of feeding standards to the practical farmer, C. D. WOODS (*Rpt. Maine Bd. Agr. 1898, pp. 161–178*).—An address (with discussion) delivered at the annual meeting of the Maine Board of Agriculture.

Straw vs. shavings as bedding for cattle and horses, E. H. HOWARD (*New York State Lunacy Com. Rpt. 1897–98, I, pp. 295, 296*).—On the basis of a test of one week's duration in a cow and horse stable at the Rochester State Hospital, the author concludes that under the local conditions straw is 40 per cent cheaper than shavings for bedding. A brief discussion of the report is given.

Stock feeding in its relation to the fertility of the farm, B. W. MCKEEN (*Rhode

Island State Bd. Agr. Rpt. 1898, pp. 238–250).—A popular article discussing the value of manure and urine of farm animals and the best methods of utilizing them.

The cattle industry of Colorado, Wyoming, and Nevada, and the sheep industry of Colorado in 1897, J. T. McNeely (*U. S. Dept. Agr., Bureau of Animal Industry Rpt. 1898, pp. 377–381*).—A descriptive and statistical article.

The horse useful (*Kansas State Bd. Agr. Quart. Rpt. 1899, Dec. 31, pp. 1–180, pls. 21, figs. 18*).—The bulletin contains a number of articles on different breeds of horses, management and care of horses, feeding mares and colts, diseases of horses, etc.

The military administration of Germany and its relation to national horse breeding (*U. S. Dept. Agr., Bureau of Animal Industry Rpt. 1898, pp. 372–376, pls. 5*).—This is a free translation of a recent publication of the German War Department describing the requirements for army horses. The conditions attending the use of brood mares from the Royal Cavalry Supply Depot at Karlsruhe for breeding are discussed.

Breeding zebras (*U. S. Dept. Agr., Bureau of Animal Industry Rpt. 1898, pp. 369–371, pls. 2*).—A brief account is given of the experiments of Baron de Paraná of Brazil in crossing the zebra on a common mare.

Poultry division, A. A. Brigham (*Rhode Island Sta. Rpt. 1898, pp. 206–211*).—The author discusses some of the requirements for successful poultry raising which are often neglected, insists on the need of good ventilation and describes briefly an apparatus for insuring it.

Farm poultry (*Bul. North Carolina State Bd. Agr., 21 (1900), No. 2, pp. 32*).—A popular article describing various breeds of poultry, ducks, geese, and turkeys; the diseases of poultry, poultry houses, preserving eggs, etc.

The farmer's poultry, S. Cushman (*Rhode Island State Bd. Agr. Rpt. 1898, pp. 177–190*).—As stated in the subtitle, this article contains suggestions as to housing, feeding, breeding, and marketing poultry.

DAIRY FARMING—DAIRYING.

Comparison of fall and spring calves and cows at Ultuna Agricultural College, 1861–1893, K. Oeberg (*Nord. Mejeri Tidn., 14 (1899), No. 30, p. 410*).—The author has compiled the data found on the records of the dairy herd at Ultuna Agricultural College (Sweden) to ascertain what difference, if any, exists between calves and cows dropped in the fall (October to January) and in the spring (March to June) as regards live weight, increase in weight, subsequent milk yields, longevity, etc. The records for calves extend from 1873 to 1880, inclusive, and those for cows from 1861 to 1893. Nothing is said as to the number of animals included in the compilation. [The dairy herd at Ultuna in 1896, at the visit of the writer, numbered 209 animals, of which 135 were milk cows, largely Ayrshires.—W.]

The average data are presented in the following table:

Comparison of calves and cows dropped in the fall and in the spring.

	Spring calves.	Fall calves.
Calves:	*Pounds.*	*Pounds.*
Average weight at birth	66.3	60.0
Weight at close of milk feeding (21 weeks)	296.4	306.7
Increase in live weight	230.1	246.7
Cows from spring and fall calves:		
Average live weight	1,102.0	1,102.0
Average yield of milk per year	4,628.0	4,786.6

While the data for a single year often differ considerably as to live weight, milk yield, and age, the average results for all the years are practically identical as regards the weight and age which the cows attained, while the cows dropped in the fall produced on the average 113 lbs. more milk per year per head than those dropped in the spring. The raising of fall calves is to be preferred, among other reasons, because such calves will be large enough to be put on pasture the following spring, and come in in the fall, producing the most milk at the time when it brings the highest price.—F. W. WOLL.

Effect of alcohol on the secretion of milk, R. ROSEMANN (*Arch. Phys. [Pflüger], 78 (1900), No. 9–10, pp. 466–504*).—The author reports 2 experiments with 2 cows. In the first experiment, which lasted a month, 96 per cent alcohol was added to the drinking water, giving 300 cc. of alcohol per head daily at first and gradually increasing the amount to 600 cc. The cow was perceptibly affected by the larger amounts of alcohol, appearing at times to be intoxicated. The yield and composition of the milk from the morning's and night's milkings of each day are given. In the second experiment only 300 cc. of alcohol per day was given as the maximum amount. The transmission of alcohol to the milk was studied especially in this period.

The author summarizes his results with the statements that (1) the feeding of alcohol had no effect on the secretion of the normal milk constituents; and (2) when given in moderate doses there was no transmission of alcohol to the milk, and when given in large doses only a very small amount of alcohol appeared in the milk, representing at the most from 0.2 to 0.6 per cent of the alcohol fed.

The literature of the subject is reviewed and discussed.

A contribution to the question of the source of milk fat, W. CASPARI (*Arch. Anat. u. Physiol., Physiol. Abt., 1899, Sup. 1, pp. 267–280*).—This work is somewhat similar to that of Winternitz (E. S. R., 9, p. 690). A dog was used, and nitrogenous and carbonaceous rations were fed in different periods, with the addition of iodin fat. It was found on a meat diet that a not inconsiderable amount of the iodin fat of the food might be transmitted to the milk. In one case 23 per cent of the fat of the milk is calculated to have been derived directly from the food, which contained 63 per cent of its fat in the form of iodin fat. In the period immediately following, when no iodin fat was fed, from 4 to 8 per cent of the milk fat was found to be iodin fat, which must have been derived from the body supply. When carbohydrates predominated largely and iodin fat was added, the latter was found in the milk fat, up to 32 per cent. The author believes that although the fat of the body may be drawn upon for the production of milk fat, under like circumstances the organism gives the preference to the food fat.

The properties of asses' milk, ELLENBERGER (*Arch. Anat. u. Physiol., Physiol. Abt., 1899, No. 1–2, pp. 32–52*).—The article treats of the chemical and physical properties of asses' milk, its digestibility in artificial digestion trials, the composition of colostrum, and comparisons of asses' milk with human milk and cows' milk.

In a summary the author states that asses' milk is characterized by its singular chemical composition, especially its low fat content (usually about 1 per cent), its approximate agreement with human milk in albuminoids, its relatively high albumin content, with an entire absence of nucleo albumin, and its relatively larger content of milk sugar, averaging about 6 per cent. It is further characterized by a strongly alkaline reaction, a singular appearance, a peculiar odor and taste, its behavior toward acids, rennet, and pepsin, and by a frequent curdling on cooking. It is more easily digested than cows' milk, and in its digestion leaves no residue of nuclein or paranuclein. It agrees very well with children and adults and is well assimilated.

The effect of food on the hardness of butter and composition of butter fat, J. M. BARTLETT (*Maine Sta. Rpt. 1898, pp. 97–113*).—The author notes the work of a number of investigators on the effect of food on butter fat and reports experiments carried on during 3 winters, the primary object of which was to study the effect of gluten meals, varying greatly in fat content, on the texture of butter and the composition of butter fat. The data for the experiments are presented in tabular form and discussed and notes are given on methods of determining the hardness of butter.

The first experiment was made with 3 cows and covered 4 periods of 2 weeks each. Two gluten meals, one containing from 15 to 20 per cent of fat and the other from 7 to 10 per cent, were compared with cottonseed meal. The second experiment included 4 cows and extended over 5 periods of 3 weeks each, with transition periods of 1 week each. Flax meal was used in addition to the gluten meals in making up the different rations. In all the experiments the basal ration, consisting of hay and silage, was practically the same. The results of the 2 experiments indicated that the gluten rations containing large amounts of fat produced softer butter than those containing smaller amounts.

In the third experiment, made with 4 cows and covering 3 periods of 4 weeks each, the object was to determine whether it was the quality or the quantity of fat that affected the butter. The contrasted rations fed during the 3 periods contained an extracted gluten meal having a fat content of less than 3 per cent, tallow and extracted gluten meal, and the gluten meals used in the previous experiments. It was found that the butter was harder and the melting point of the butter fat higher during the period when tallow was added to the extracted gluten meal ration than during the period when the same ration was fed without the tallow. The author's conclusions follow:

"(1) The hardness of butter can be regulated to a large extent by the food of the cows.

"(2) Gluten products, such as gluten meal, feeds, etc., containing large percentages of oil produce soft butter and should not be fed to dairy cows used for butter production.

“(3) Gluten meals containing small percentages of fat, 3 per cent or less, and high percentages of protein, when fed in combination with corn meal and bran, will make butter sufficiently hard for this climate.

“(4) The glutens, however, if freed from fat will not produce butter of more than normal hardness and do not have the hardening effect of cotton-seed meals; when a very hard butter is desired some cotton-seed meal should be fed.”

The effect of feeding fat on the fat content of the milk, J. M. BARTLETT (*Maine Sta. Rpt. 1898, pp. 114–117*).—In the third experiment noted above the effect of the food upon the yield of butter fat was also studied. Owing to a partial loss of the records satisfactory conclusions could not be drawn. “The results are of interest, however, in showing the very decided increase in fat content of the milk for the first 2 weeks of the period when a ration rich in fat was fed, and also the decided drop in the third week.”

The content of volatile fatty acids in butter, P. VIETH (*Milch Ztg., 28 (1899), No. 50, pp. 785–787*).—The author reports investigations concerning the range in content of volatile fatty acids in butter, discusses the causes of variation, and reviews the work of other investigators.

A study was made of the butter fat from a herd of 60 cows. The herd was composed mainly of Shorthorns, but contained also some Kerry and Jersey cows. The Reichert number for the whole herd for 17 months ranged from 20.4 to 26.8, and for the different breeds for 3 months as follows: Shorthorn 21.4 to 25.9, Kerry 22.5 to 28.6, Jersey 20.3 to 27.2. The number for one Shorthorn cow 19 days after calving was 25.1. During the ninth and tenth months of lactation the number for another Shorthorn cow varied from 18.6 to 17.6, and for a third cow during the fourteenth and fifteenth months from 16.3 to 14.7.

Tests extending through one year were made of the butter from four private dairy herds. Herd 1 contained about 800 cows, with a daily milk production ranging throughout the year from 4,000 to 10,500 kg. Herd 2 contained about 1,200 cows, the daily yield of milk ranging from 5,000 to 14,000 kg. Herd 3 included about 2,500 cows, yielding from 5,000 kg. of milk per day in February to 24,000 in June. Herd 4 consisted of about 550 cows, producing daily from 2,000 to 8,000 kg. of milk. The methods of handling the different herds and the conditions affecting the work are described. Each herd was pastured without additional feed from May to October and stabled and fed during the remainder of the year. The larger number of the cows of herd 1 were fresh in February, herd 2 from October to March, herd 3 during the last half of March and the first half of April, and of herd 4 in April. The Reichert number for the different herds varied during the year as follows: Herd 1, 24.9 to 30.2; herd 2, 23.9 to 29.1; herd 3, 22.8 to 30.6; and herd 4, 22.8 to 31.3, averaging, respectively, 27.6, 27.2, 26.9, and 27.1. In general the Reichert number for the different herds was 28 or above from the first of February to the first of July and lowest during October. The results are held to show a connection between the decrease in the

volatile fatty acids of the butter and advance in the period of lactation, but furnish no conclusive evidence of the effect of other factors.

Report upon experimental exports of butter, 1897, H. E. ALVORD (*U. S. Dept. Agr., Bureau of Animal Industry Rpt. 1898, pp. 83–136, pl. 1, figs. 6, dgm. 1*).—This is a report on experimental exports of selected creamery butter to British markets. The work was carried on by the Dairy Division of this Department, and included 9 shipments made from May to October, 1897, a full account of which is given. The butter exported was made at creameries in Connecticut, Iowa, Kansas, Massachusetts, Minnesota, New Hampshire, New York, Ohio, South Dakota, Vermont, and Wisconsin, and was prepared in practically the same manner as for home markets.

The author considers at some length the requirements of the London market, facilities for transportation on land and sea, time and cost of transportation, composition and quality of the butter exported as compared with that found in the London market, and profits from the trial shipments.

No satisfactory comparison of the butter exported by the Department and foreign butters by experts in London could be obtained. The general expressions of merchants, retail dealers, and consumers, extracts from which are given, "upon being merged in a 'composite' form, seem to place the best States butter as second to the Danish, Swedish, and best French, and no more than equal to the best Irish, Australian, and Canadian." The evidence, however, is considered conclusive that in nearly all cases the butter was retailed to consumers at the very highest prices paid for salted butter. As a business operation the results of the year are considered as reasonably satisfactory.

Appendixes to the report contain statistics on the exports of butter, imitation butter, and oleo oil from the United States; imports of butter into the United Kingdom; data in regard to the shipments made by the Department; an account of tests of the relative merits upon reaching the London market and the comparative keeping quality of butter as usually made and that made from pasteurized cream; the results of a trial in shipping unsalted butter; scoring and analyses of the butter exported and of foreign made butters; and a diagram showing the prices of butter in New York and London during 1897.

The results of the experiments in pasteurization are not considered by the author as conclusive, but as furnishing an instructive contribution to the subject. The work was done at Newton, Kans., by J. H. Monrad, whose conclusions follow:

"(1) Even for the home market, pasteurization will make some improvement in the butter of at least 75 creameries in every 100.

"(2) Fully as good 'body' can be obtained in butter made from pasteurized cream as from raw cream.

"(3) Heating cream even to 170° and hauling it 12 miles while hot is perfectly practicable, although the butter thus made did not show any higher scoring at the first trial as a result of this treatment.

"(4) With the proper arrangements the pasteurization of cream need not be much extra work aside from the cleaning of apparatus; but an extra man is needed if the preparing of starter and the care of the cream, as well as the extra cleaning, is to be given the proper attention.

"(5) A large supply of ice or a refrigerating machine is necessary in order to chill the cream sufficiently to get a good 'body.'

"(6) In ripening cream a lower acid seems better adapted to a very rich cream, and there are indications that a better flavor can be obtained from thin cream."

Two trials were made of exporting unsalted butter. The results were unsatisfactory on account of a portion of the butter becoming moldy and several accidents, but indicated the possibility of placing on the London market fresh roll butter made in the United States equaling in quality and condition that from the north of France, which brings the highest price in London.

Analyses numbering 35 in all were made at several experiment stations and at this Department of the different lots of butter exported, and 33 analyses were made of selected lots of the best butter to be found in London from 9 foreign sources. Analyses were also made by public analysts in London of the butter exported by the Department. The results, comparing the content of water and butter fat, are summarized in the following table:

Comparative composition of butter, United States and foreign.

Butter—where made and where analyzed.	Water.			Butter fat.		
	Lowest	Highest.	Average	Lowest	Highest.	Average.
United States	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*
American analyses	8 12	12 87	10 85	84 21	89 49	86 84
London analyses	8 08	11 73	10 13	86 71	90.09	88 06
Foreign, United States analyses	8 62	15 50	12 40	78.50	89 27	84 57

Bacteria in butter and other milk products, WEISSENFELD (*Berlin. Klin. Wchnschr., 36 (1899), p. 1053; abs. in Chem. Ztg., 23 (1899), No. 98, Repert., p. 365*).—The author examined 32 samples of butter, partly from creamery and partly from peasant farms in the vicinity of Bonn, for tubercle bacilli, using the Obermüller method. Ten samples produced tuberculosis, but only 3 the true tuberculosis, the remainder being the pseudo form. Of the 22 samples of butter which gave negative results, 20 contained no pathogenic organisms, while one sample killed the animal by peritonitis and another, made from pasteurized milk, contained a rod bacillus which was not isolated.

Various albuminoid and casein preparations made from milk were examined with the result that some were found to contain large numbers of living bacteria.

Action of micro-organisms on butter fat, DUCLAUX (*Ind. Lait., 24 (1899), Nos. 42, pp. 333, 334; 43, pp. 341, 342*).—A sample of butter was melted and a portion of the fat decanted. The remaining portion of the sample was emulsified and subjected to the action of Penicillum. At the beginning of the experiment the fat contained 3.2 per cent butyric acid and 1.6 per cent caproic acid. At the end of 6 weeks the content of these two acids had decreased from 4.8 to 4.5 per cent. This diminution was found due to both evaporation and assimilation by the fungus. Three months later the content of volatile fatty acids estimated as butyric was 2.5 per cent. Nine months after the last determination the percentage of butyric acid was 1.16 and caproic acid 1.02, making a total of 2.18. The slight loss in volatile fatty acids during the last period is attributed to the feeble growth of the Penicillum. Butyrin was saponified by the fungus more easily than caproin and both of these more readily than the other glycerids.

It is noted that a sample of the butter used in the experiment exposed to the influence of the sun from November 15 to April 15 increased in weight 1.3 per cent and in content of volatile fatty acids from 4.80 to 5.48 per cent.

An investigation was made of the changes in the composition of cheese which had been kept in a damp cellar for 5 years. The water content of the cheese had increased from about 44 to 50.68 per cent. The residue from the ether extract, amounting to 28.31 per cent, was brown and viscous. A resinous substance was isolated from this residue and a preliminary study made of its properties. After deducting 5 per cent for the salt content there remained 16 01 per cent for the casein and nitrogenous substances. The fat content instead of being nearly equal to that of the casein, as in the fresh cheese, was from 1½ to 2 times as great. This proportion is considered in reality still greater, as fatty acids combined with the ammonia during the changes which had taken place in the cheese are estimated with the casein. Of the casein 5.48 per cent was found soluble in boiling water and 7.31 per cent soluble in strong alcohol. As compared with fresh cheese these figures are considered as showing the extensive changes that had taken place in the casein. Seventy-five per cent of the casein soluble in warm water and alcohol passed through a porcelain filter. The volatile fatty acids of the cheese, estimated as butyric, was about 0.05 per cent. The content of free ammonia was 0.5 per cent and of ammonia in combination with fatty acids 1.9 per cent.

Similar though less marked results were obtained in an examination of a cheese 8 months old. The water content was 36.26, fat 34.70, casein and nitrogenous substances 24.59, and salts 4.45 per cent.

The changes in the composition of the fat in the cheese are pointed out as intimately correlated with those taking place in the casein. By the action of the micro organisms ammonia is liberated from the casein, which renders the mass alkaline and causes a saponification of the fat. The fatty acids in turn neutralize the ammonia and permit the action of the germs to continue.

Bacteriological examinations for the dairy service, J. A. GILRUTH (*New Zealand Dept. Agr. Rpt. 1899, pp. 89—91*).—Water from a creamery at which there had been complaints of the butter was found to contain about 2,000 germs per cubic centimeter, composed of equal numbers of *Bacillus fluorescens nonliquefaciens* and what appeared to be *B. fluorescens liquefaciens*. The latter produced "a peculiar fetid odor" when grown on gelatin or bouillon, and this was found to be the case also when inoculated into tubes of butter, both when kept at room temperature and when placed in cold storage at about 45° F. Under the latter conditions the odor was discernible in 3 days. Keeping the organism in tubes of glycerine and of butter in a freezing chamber, maintained constantly below 32° F., did not interfere with its activity when thawed out.

"The above indicates how butter may possibly become contaminated with deleterious germs through the water used for washing, and that it would be possible for butter harboring such germs to be graded first-class here, yet, soon after arrival in London, to become uneatable."

A sample of well water from another creamery contained about 13,000 organisms per cubic centimeter, and the water from a stream flowing near the well, which probably supplied the latter in part, contained about 200,000 organisms. *Bacillus coli* was present in both samples. A sample of butter from the creamery contained as many as 64,000 organisms in what could be raised on the point of a fine platinum needle. The odor of the gelatin culture indicated the presence of a number of putrefactive bacteria, but no odor was detected when inoculated into sterilized butter.

Examinations of the water supply of several other factories are briefly mentioned as indicating the desirability of a system of filtration of the water supply.

The author examined a box of butter which had been frozen in New Zealand, sent to England, and returned in the freezing chamber. The number of bacteria present was estimated at from 6,000 to 8,000 per grain, the chief organisms being "staphylococci" and "red bacillus." Other samples of butter which had been frozen for various periods were found to contain as many as 10,000 organisms per grain.

"These results indicate the necessity there is in dairying for having utensils and water supply, all of which may be sources of contamination, as well as the milk, free from foreign bacteria."

Vitality and retention of virulence by certain pathogenic bacteria in milk and its products, O. F. DAWSON (*U. S. Dept. Agr., Bureau of Animal Industry Rpt. 1898, pp. 224–228*).—Milk was inoculated with the bacteria of swine plague and then used for making butter. The virulence of the culture was determined at the beginning by inoculating a healthy rabbit, and inoculations were made at different stages in the process of butter making. The author concludes that "something (acid) is formed in the milk during the manufacture of butter by the ordinary method which is in 36 hours present in sufficient quantity to lessen the virulence of the swine plague bacterium, and that in 24 hours it is present in sufficient quantity to render this bacterium nonvirulent or to kill it entirely."

Similar experiments were made with the hog cholera bacillus, showing that "the hog cholera bacillus is more resistant than the swine plague bacteria. . . . Not until the fifth month does the organism begin to lose its virulence." The experiments also show that "hog cholera could be carried in sour milk and in butter, and that the organism remains virulent for at least 12 months in commercial butter."

Butter was infected with a virulent culture of tubercle bacilli and tested from time to time on guinea pigs. According to the results "the bacillus retains its virulence pretty uniformly for about 3 months, when it begins to attenuate. At the eighth month its virulence was considerably decreased."

A case is mentioned of an outbreak of tuberculosis in swine in which the source of infection was believed to have been traced to the refuse from a creamery upon which the pigs fed.

Chemical studies on the ripening of two kinds of brick cheese, O. LAXA (*Ztschr. Untersuch. Nahr. u. Genussmtl., 2 (1899), No. 11, pp. 851–859*).—These studies were on the Bohemian Harrach and Konopister cheeses. Analyses were made of the cheeses when fresh and at different stages of ripening, and special determinations were made of the different forms of nitrogenous compounds present, the individual ash constituents, and the physical constants. The author summarizes the results of his investigation as follows:

(1) The amount of water in the cheeses decreases through evaporation from the surface.

(2) The total solids decrease by decomposition of the sugar and the albuminoids.

(3) The milk sugar is completely decomposed by micro organisms, principally lactic-acid bacteria and yeasts.

(4) The lactic acid is in part broken up by micro-organisms, and in part changed by them to volatile acids.

(5) The casein is changed principally to caseogluten, less to amido compounds—ammonia and volatile fatty acids; the nitrogen is slightly diminished.

(6) The ash is diminished to a slight extent by mechanical means. The salt is transformed into soluble sodium phosphate, which by osmose is transferred to the surface and there separates insoluble calcium phosphate.

(7) There was no change in the amount of fat in the interior, or, if any, a decrease. On the surface, where the decomposition was greatest, there was an apparent relative increase, which is thought to be due to the extraction of nonfatty substances by the ether in the fat determination. The superficial fat was decomposed and the fatty acids set free, increasing the acid number.

The importance of lactic-acid ferments for the formation of albuminoid decomposition products in Emmenthaler cheese, together with some remarks on the ripening process, E. VON FREUDENREICH and O. JENSEN (*Landw. Jahrb. Schweiz, 13 (1899), pp.*

169–197; Milch Ztg., 28 (1899), Nos. 48, pp. 758–760; 49, pp. 773–775; 50, pp. 790, 791; 52, pp. 822–825).—The authors report experiments in making small experimental cheeses and cheeses of normal size from pasteurized milk inoculated with different forms of lactic-acid bacteria, Duclaux's tyrothrix bacilli, etc. Sixteen of the small cheeses were made. The results are interpreted to show that the ripened cheeses which had been inoculated with the lactic-acid bacteria contained more amid nitrogen than the control cheeses or those inoculated with tyrothrix bacilli. The latter contained the least of all. The cheese inoculated with lactic-acid bacteria had the taste of ripened cheese, while this was less marked in the other cheeses, or entirely absent. This fact is held to show that the decomposition products formed by the lactic-acid bacteria are the characteristic ones of ripened cheese.

The largest amount of soluble nitrogenous compounds was contained in the cheese which was not inoculated with micro-organisms of any kind. This, the authors believe, indicates that the change of the casein into soluble proteids is due, at least partially, to other causes than the lactic-acid bacteria, and that the principal mission of the latter is to further decompose the soluble proteids, although other experiments by the authors are held to show that lactic-acid bacteria are also able to produce soluble proteids.

The authors discuss the probable cause of the change in the casein in pasteurized and uninoculated cheese, mentioning liquefying bacteria and the ferment in milk discovered by Babcock and Russell. In regard to the possibility of the changes being due to liquefying bacteria, additional experiments showed that liquefying bacteria are not able to live in hard cheese, and rapidly decrease. This is especially the case when lactic-acid bacteria are present. Cheese made from pasteurized milk inoculated with spores of *Tyrothrix tenuis* (to eliminate the possible action of the enzym supposed to be formed by this micro-organism), and likewise uninoculated cheese, contained only the soluble and amid nitrogen, which was found in very fresh cheese. This is held to indicate that the natural enzym, which was destroyed by pasteurizing, plays a part in the process. The tyrothrix spores introduced into cheese did not develop, and no ripening took place. An experiment with lactic-acid bacteria (2 forms) inoculated into milk pasteurized at 90° C. "shows that the lactic-acid ferments can render the casein of cheese soluble without the aid of the natural milk enzym." From 4.26 to 5.26 per cent of the total nitrogen of the cheese (2 months old) was rendered soluble, and from ⅓ to about ¼ of these amounts was changed to amid nitrogen. [The authors' results show that in another similar experiment with cheese pasteurized at 90° and uninoculated, the cheese "contained very many *Bacillus schafferi*" when 2 months old, and that 4.98 per cent of the total nitrogen had been rendered soluble; furthermore, in another case cheese made from milk pasteurized at 85° C. for 5 minutes and not inoculated, contained *Bacillus acidi lactici* when 2 months old, and 4.06 per cent of the nitrogen had been rendered soluble.]

From this series of experiments with small experimental cheeses the authors draw the following conclusions:

(1) The liquefying bacteria, as *Tyrothrix tenuis* and *Bacillus I*, take absolutely no part in rendering soluble the casein of normal Emmenthaler cheese, which always contains large numbers of lactic-acid bacteria. The latter suppress the liquefying bacteria and hinder their development.

(2) Liquefying bacteria of the order of *Bacillus I* develop, at least in the earlier stages, in cheese made from pasteurized milk, in which the majority of the lactic-acid bacteria are killed or weakened, and render a part of the casein soluble. In such cheese the natural milk ferment of Babcock and Russell seems to play a part.

(3) The lactic-acid ferments can render the casein of cheese soluble without the aid of the natural milk enzym. For the present we are unable to determine how much of the solvent action on the casein in normal cheese is due to the action of the lactic-acid ferments and how much to the action of the natural milk enzym.

The reason given for the fact that the cheese made from pasteurized milk not inoculated with lactic-acid bacteria contained the largest amount of soluble nitrogen, is that such cheese did not become as acid as cheese containing the lactic-acid bacteria, and that the peptonizing action of both the lactic-acid bacteria and the natural milk enzym is weakened by the presence of acid.

Seven large cheeses were made in the creamery of the dairy school at Rütti by an expert cheese maker. In all cases the milk was pasteurized, remaining uninoculated in one case, and being inoculated with tyrothrix bacilli in one case and with laboratory cultures of lactic acid bacteria in three others. Rennet tablets were used in these 5 cases, and in the remaining 2 natural rennet was used, the milk not being inoculated. Considerable difficulty was experienced in making Emmenthaler cheese from pasteurized milk, the cheese lacking the proper consistency and porous condition.

The uninoculated cheese made with rennet tablets ripened least of all, although it was found to contain considerable numbers of lactic-acid bacteria. In time this cheese had the taste of ripened cheese. The tyrothrix bacilli imparted a bad taste to the cheese. The taste of the cheese inoculated with lactic-acid bacteria was that of ripened cheese, but it was not comparable with that of normal cheese. In general the results agreed with those obtained in the former series with experimental cheeses. The uninoculated cheese and that treated with tyrothrix contained less albuminoid nitrogen than that treated with lactic-acid bacteria, but the latter in turn contained less than the cheese made with natural rennet. The largest amount of soluble nitrogen was found in the cheese made with rennet tablets from uninoculated pasteurized milk.

Lecithin and traces of glycerin-phosphoric acid were found to be constituents of cheese, and in every case the lecithin decreased and the glycerin-phosphoric acid increased as the cheese ripened. It is suggested that the lecithin is gradually decomposed to glycerin-phosphoric acid, cholin, and higher fatty acids.

The following conclusions from the investigations are given:

(1) In the ripening of Emmenthaler cheese the so-called tyrothrix bacilli take no part. They do not multiply in normal cheese, and even when introduced in large numbers they have no effect on the formation of decomposition products. In general they have an injurious effect on the taste.

(2) The chief part in the ripening is taken by the lactic-acid bacteria, which multiply abundantly in cheese. These are capable of rendering the casein of cheese soluble and forming the decomposition products characteristic of ripe cheese.

(3) It is not improbable that the inherent milk enzym discovered by Babcock and Russell takes a part in ripening, by rendering the casein soluble and so lightening the work of the lactic-acid ferments.

(4) The pasteurizing of milk for Emmenthaler cheese unfavorably affects the quality of the cheese, and consequently is not applicable in practice.

(5) A loss of soluble cheese constituents during ripening has been confirmed, and lecithin and traces of glycerin-phosphoric acid have been recognized as new constituents of cheese.

Breeds of dairy cattle, H E. ALVORD (*U. S. Dept. Agr., Bureau of Animal Industry Rpt. 1898, pp. 137–200, figs. 35*).—This deals with the origin and history, characteristics, milk and butter records, and types of the following breeds: Ayrshire, Brown Swiss, Devon, Dutch Belted, Guernsey, Holstein, Jersey, Normandy, Polled Durham, Red Poll, Shorthorn, and Simmenthaler. Illustrations are given of a bull and a cow of each breed. An appendix contains information relative to comparison of dairy breeds, points observed in judging dairy cattle, number of registered cattle in the United States, scale of points in use in the United States for judging different breeds of dairy cattle, and organizations of breeders of pure-bred cattle.

Breeds of dairy cattle, H. E. ALVORD (*U. S. Department of Agr., Farmers' Bul. 106, pp. 48, figs. 21*).—A reprint of the above, slightly revised and abridged.

The selection, breeding, and handling of the modern dairy cow to secure most profit, V. E. FULLER (*Rpt. Maine Bd. Agr. 1898, pp. 178–197*).—A popular discourse based largely on experience.

H. O. dairy feed for cows, T. WILDING (*New York State Lunacy Com. Rpt. 1897–98, 1, pp. 278, 279*).—The regular ration, consisting of 10 lbs. of middlings and 2 lbs. of linseed meal per cow daily, was compared with 12 lbs. of H. O. dairy feed, silage being fed with each ration. Three cows were used. The milk yield was very slightly larger on the H. O. feed, "but with the average cost of middlings and oil meal I feel satisfied that there is nothing to be gained in changing to the H. O. dairy feed."

Economical dairy foods, J. L. HILLS (*Rpt. Maine Bd. Agr. 1898, pp. 125–155*).—A popular discourse in which the respective values and economics of different classes of dairy foods are pointed out.

Herd records, G. M. GOWELL (*Maine Sta. Rpt. 1898, pp. 148–157*).—This is a monthly record of 24 cows for 1898, giving the yields of milk, fat, and butter from each cow. "Discussion of the data will not be undertaken until more results are secured and tabulated."

Milk, its properties and composition, M. KLIMMER (*Arch. Wiss. u. Prakt. Thierh., 26 (1900), No. 1, pp. 40–69*).—The author lays down the proposition that in the future milk control can not continue to be a purely chemical control, but in order to completely fulfill its mission it must be preeminently a veterinary control.

The article gives a brief review of the literature of milk, with a view to furnishing veterinarians with general information on the physical properties and chemical composition of milk, the variations in content of solids and fat, and the influence of various internal and external conditions on the composition. A bibliography of 148 titles is given.

Two further articles are promised on the adulteration of milk and its detection, and on milk hygiene.

Clarification of milk (*Hoard's Dairyman, 31 (1900), No. 5, p. 90*).—The term is applied to the process of removing impurities from milk by the use of a centrifugal separator so adjusted that the spouts empty into one vat where the skim milk and cream are mixed before bottling. The author notes the practical use made of the method and its advantages, and recommends that milk be clarified cold to lessen the loss of casein.

The occurrence of chromates as preservatives in milk, A. LEYS (*Jour. Pharm. et Chim., 6. ser., 10 (1899), pp. 337-340; abs. in Analyst, 25 (1900), Jan., p. 9*).—During the past year the author has often found chromates associated with formaldehyde, most frequently in the proportion of 1 part in 1,000 parts of milk, though considerably larger quantities have been used. Two tests for chromates are described.

Butter, W. A. WITHERS and J. M. PICKEL (*North Carolina Sta. Bul. 166, pp. 377-386*).—An introductory statement concerning the number and value of milch cows in the State is followed by a popular discussion of the chemical composition of animal fats, manufacture of oleomargarine, adulterants of butter and their detection, and adulteration of butter in North Carolina. Of 15 samples bought for butter in the open market and analyzed at the station one was found to be oleomargarine.

Butter export, C. L. MCKAY (*Western Creamery, 5 (1900), No. 6, pp. 13, 14*).—A brief discussion on the manufacture of butter for foreign markets.

Colored spots in cheese, R. A. PEARSON (*U. S. Dept. Agr., Bureau of Animal Industry Rpt. 1898, pp. 229-234*).—A reprint of Circular 24 of the Bureau (E. S. R., 10, p. 593).

The home of Edam cheese, J. W. DECKER (*New York Produce Rev. and Amer. Creamery, 1900, Feb. 14, pp. 54-58, figs. 7*).—An illustrated description of the manufacture and sale of Edam cheese in Holland.

Fifty dairy rules (*U. S. Dept. Agr., Bureau of Animal Industry Rpt. 1898, pp. 201-204*).—Reprinted from Farmers' Bulletin 63 (E. S. R., 9, p. 886).

The sanitary aspects of dairying, T. SMITH (*Rpt. Maine Bd. Agr. 1898, pp. 197-224*).—A popular article dealing with milk supply and sanitation, danger from tuberculosis, improvement of sanitary conditions of the dairy, etc.

Meat and milk inspection in Shanghai, W. J. BLACKWOOD (*U. S. Dept. Agr., Bureau of Animal Industry Rpt. 1898, pp. 205-212*).

The so-called air churn, W. J. SPILLMAN (*Dairy Reporter, 3 (1900), No. 33, p. 526*).—Cautions farmers against the purchase of new and untested dairy apparatus.

VETERINARY SCIENCE AND PRACTICE.

Laboratory methods for the diagnosis of certain micro-organismal diseases, C. F. DAWSON (*U. S. Dept. Agr., Bureau of Animal Industry Rpt. 1898, pp. 335-354, pls. 7*).—This paper presents details of methods for differential diagnoses of various diseases. Anthrax bacillus is readily stained blue with Loeffler's alkaline methylin blue. The organisms appear as rods with square ends, never blunt or round. In the case of malignant edema, the organism may be observed in chains, and the opposing ends are usually square, resembling in this respect the organism of anthrax. The terminal cell of the chain, however, is always rounded on the free end and never square. This differentiates the organism readily from that of anthrax.

The specific organism of rabies has never been isolated, but the most reliable of various methods adopted for diagnosis of rabies is that of subdural inoculation in rabbits. In the case of actinomycosis, if a small bit of a suspected tumor is crushed under a cover glass the organism, if present, will be seen as a mass of minute rays projecting from the center. The rays are club-shaped at the peripheral ends.

A brief description is given of a method for demonstrating the presence of Texas fever organism in the blood. This organism, being a protozoon called *Pyrosoma bigeminum*, has never been successfully cultivated upon nutrient media. In the diagnosis of tuberculosis, the author mentions the use of tuberculin and various stains for the tubercle bacillus. In the diagnosis of blackleg, it is to be remembered that this disease is not found in horses, adult cattle, or in swine. In anthrax the spleen is enlarged, but never in blackleg. The bacillus of blackleg is of about the same length and half as broad as that of malignant edema. The latter bacillus kills rabbits and guinea pigs, while the bacillus of blackleg is not known to be fatal to rabbits.

In tetanus the diagnosis usually depends upon clinical history. Death may occur in from 4 to 5 days. Difficulty in mastication and deglutition are early symptoms in the horse. The spine and legs become rigid, the tail being elevated and motionless. The muscular system becomes tetanic and a cold perspiration is often present. In the diagnosis of glanders the author mentions the use of mallein inoculations, and hypodermic injection of nasal discharge of suspected animals in guinea pigs. If the glanders organism is present in this material, in male guinea pigs acute orchitis is developed within from 48 to 72 hours. In making a differential diagnosis between swine plague and hog cholera, attention is called to the habit of the hog cholera bacillus to form clumps and to become agglutinated. This reaction is never noticed in the case of the organism of swine plague.

Chicken cholera should present little difficulty, from the fact that the germ is present in the blood in large numbers and the clinical symptoms are characteristic. In infectious leukæmia, a diagnosis can be readily reached by discovering the *Bacterium sanguinarium* in the feces of affected fowls. In tuberculosis of fowls, it should be remembered that the tubercles often appear as hard, horny, or soft and cheesy swellings on the skin and joints. In about 50 per cent of the cases the tubercles appear as round masses in the intestinal walls. Entero-hepatitis in turkeys may be readily diagnosed by finding *Amœba meleagridis*, which is the pathogenic organism of the disease.

In studying roup of fowls, the membranous patches in the mouth, throat, and nose should be ground up in a salt solution and injected hypodermically in small experimental animals. Nodular tæniasis may be differentiated from tuberculosis in fowls by the fact that in tuberculosis, lesions will be found also in the liver or other organs, while in nodular tæniasis no such lesions will be found except in the walls of the intestines.

A nodular disease of sheep, which has been mistaken for tuberculosis, may be readily recognized by the finding of the pathological agent, which is a nematode worm, *Œsophagostoma columbianum.*

The history of a tuberculous herd of cows, H. L. RUSSELL (*Wisconsin Sta. Bul. 78, pp. 16, figs. 7*).—An account is given of an outbreak of tuberculosis in a private herd, which had been improved by the purchase of some pure-bred animals, and of experiments made by the station on this herd in the application of Bang's weeding-out process. The first tuberculin test was made January 2, 1896. Thirteen out of 16 mature animals and 3 yearlings responded. Two showed physical symptoms of the disease and were slaughtered. A partition was constructed across the stable and the animals which had reacted were kept on one side, while the others were kept on the other side of this partition. The 2 sections of the herd were pastured in separate fields and watered out of different tanks. The stable was thoroughly disinfected.

On May 12 of the same year, another tuberculin test was applied, but no new cases of tuberculosis were indicated. Five calves, however, had been dropped in the meantime, 4 of them coming from the tuberculous section. These calves were separated at birth and fed on boiled milk. On April 26, 1897, a third test was applied. No new cases of tuberculosis had developed. All calves, whether from the tuberculous or nontuberculous section, were free from the disease. Two more old cows, in which the disease had progressed so as to become evident, were slaughtered. In 1898, only the young stock was tested, previous tuberculin tests having given uniform results. Two more of the original herd of tuberculous animals were killed. In February, 1899, a final test of the entire herd was made with the result that no new cases of the disease were found.

The history of the observations made upon this herd shows that the diseased animals became fewer and fewer as the more pronounced symptoms appeared, rendering the slaughter of the animals necessary; but not a single new case of the disease developed in any of the young animals. This is evidence that in this herd the disease was not inherited from the affected mother but could be contracted only after birth.

In connection with the tuberculin tests made upon this herd, it is of interest to note that none of the animals which originally reacted to tuberculin, failed to react during the subsequent tests.

The milk of this herd was frequently submitted for bacteriological examination and no tubercle bacilli were found. Calves from tuberculous mothers as well as nontuberculous mothers were allowed to suckle the reacting cows. Young cattle were also kept in contact with the affected herd in the stable and in the pasture, but in no case was the disease contracted. The author believes that the history of this herd demonstrates that a perfectly healthy herd can be built up from a tuberculous herd by this method. The results obtained would indicate that tuberculosis is not likely to be contracted from tuberculous animals until the disease has progressed so far that physical symptoms of the affection are apparent. Naturally it is impossible to say just when the milk of a tuberculous animal becomes dangerous and for this reason it is advisable always to pasteurize such milk.

The author suggests that when upon the application of the tuberculin test it is found that only a few of the herd are tuberculous, it would perhaps be advisable to slaughter these animals. When, on the other hand, more than a few or a large proportion of the herd reacts it would seem from an economic standpoint as well as from a sanitary standpoint to be inadvisable to destroy all of the reacting animals.

Tuberculosis and the station herd, F. L. RUSSELL (*Maine Sta. Rpt. 1898, pp. 136–140*).—When the tuberculin test was first applied to the college herd, a number of cows responded and all such animals were destroyed. The *post-mortem* examinations showed that certain cows had perhaps not yet become dangerous, but it was considered advisable to take strenuous measures for eradicating the disease. The barn, however, was full of hay and it was not thought possible to disinfect it. Cows were bought from the neighborhood to replace those which had been destroyed, and were subjected to the tuberculin test before placing them in the herd. During the following winter several additional cases of tuberculosis developed, and it was believed that these cases arose by infection from the stable. The stable was thoroughly disinfected, all movable objects being taken out, and walls and woodwork thoroughly sprayed with a solution of corrosive sublimate in proportion of 1 to 1,000 parts in water. Since this time no new cases of tuberculosis have developed, and it is believed that the herd is entirely free from this disease.

Some products of the tuberculosis bacillus and the treatment of experimental tuberculosis with antitoxic serum, E. A. DE SCHWEINITZ (*U. S. Dept. Agr., Bureau of Animal Industry Rpt. 1898, pp. 305–317*).—This is a reprint from Transactions of the Association of American Physicians, 1897. A crystalline substance with a melting point of 161 to 164° C. was isolated from artificial liquid cultures of the tubercle bacillus. The substance was acid, and appeared to have nearly the same formula as teraconic acid. The crystals were dissolved in water and used for experimental inoculation of guinea pigs, the indications being that it was very active in causing necrosis of the tissue. Crystals dissolved in sterile water and injected into the liver produced, after 48 hours, a number of light spots in that organ. The substance possesses some immunizing power, a single injection of 0.002 gm. being sufficient to keep the animals alive some weeks longer than the cheeks. It has the effect of reducing the temperature in healthy and diseased animals.

It was found possible to isolate another substance from cultures of the tubercle bacillus which contained an albuminoid and which caused a temperature reaction. It is believed that the different reaction to tuberculin at different times is perhaps principally due to the antagonistic action of these two substances.

Experiments were conducted to determine the effect of the injection of attenuated tubercle bacillus. At first there was a slight decrease in weight and a local swelling. In about 8 weeks after the injection, the guinea pigs were apparently well and were inoculated with the virulent germ. The checks died within 6 weeks after inoculation, while vaccinated guinea pigs were in a healthy condition 4 months afterward.

Three cattle, of which one was tuberculous and the other two healthy, were given large doses of tuberculin and attenuated culture, the tuberculous animal receiving from November, 1894, to April, 1897, 19,407 cc. of tuberculin, and the 2 healthy animals receiving 11,425 and 18,100 cc. of attenuated culture, respectively. The serum from the cow which was treated with tuberculin caused a slight resistance to tuberculosis in guinea pigs, while the serum of the 2 cows which were treated with attenuated cultures produced a greater and more prolonged resistance on the part of experimental animals. Similar results were obtained by use of the serum from horses which had been treated with attenuated cultures.

The author concludes that the injection of the live culture of tubercle bacillus produces substances which are antitoxic to tuberculosis, and slightly antitoxic material is also produced by the injection of tuberculin in healthy animals.

The attenuated Bacillus tuberculosis: Its use in producing immunity from tuberculosis in guinea pigs, E. A. DE SCHWEINITZ (*U. S. Dept. Agr., Bureau of Animal Industry Rpt. 1898, pp. 318–325*).—This is a reprint from the Medical News, December, 1894. Cultures of tubercle bacillus, which had been growing for several generations upon glycerine agar, were transferred to glycerine beef broth. After the fourteenth generation upon this culture medium, it was noticed that the germs were becoming attenuated and that the disease required 6 months for development.

Experiments were conducted to test the immunizing properties of attenuated cultures, from which the following results were obtained: Guinea pigs were apparently rendered immune to virulent cultures by repeated inoculation with an attenuated culture. A single injection of a small quantity of tuberculin seemed to increase the subsequent immunity produced by injection of the attenuated culture. Guinea pigs which were inoculated with the attenuated culture did not develop symptoms of tuberculosis, although under close observation for several months.

Texas fever, J. W. CONNAWAY and M. FRANCIS (*Missouri Sta. Bul. 48, pp. 66, figs. 11*).—The work on Texas fever which is recorded in this bulletin was carried out under the cooperation of the Missouri and Texas Experiment Stations and the Missouri State Board of Agriculture. The investigations involved the following three lines of work: (1) Experiments to determine whether sterile blood serum of immune cattle would produce immunity in other cattle; (2) experiments in immunizing cattle by tick infestation; (3) experiments in immunizing cattle by blood inoculation. The greater part of the bulletin is occupied with a report of experiments in blood inoculation. Experiments conducted with sterilized serum indicated that this substance is worthless for producing immunity in Northern cattle, and that the only way of producing immunity is by means of actual infection with the disease, either by tick infestation or by blood inoculation.

Twenty-one head of young cattle were infested with ticks, and of this number only one died from an acute attack of fever within the period of 12 to 20 days. The animal which died was a calf two months old, and was infested with an unusually large number of ticks. Later an acute fatal relapse took place in two other animals. The relapse occurred after a secondary infestation of ticks. These animals, however, were in bad condition and poorly nourished. It was concluded from these experiments in tick infestation that complete immunity can not be produced by a single infestation with the fever ticks. The immunizing process is a slow and gradual one, requiring several months or perhaps a year for its completion. The first infestation of ticks should be slight, and the subsequent infestations should not be made at too great intervals, provided that the animals endure the fever reaction which results from each infestation. It is advisable that calves be well nourished throughout the period of immunization, otherwise the growth of the calves may be stunted and fatal relapses will sometimes occur.

The authors conducted experiments in the production of immunity by blood inoculation on a large scale. From 1 to 2½ cc. of defibrinated blood was given hypodermically at each inoculation. The first dose of defibrinated blood was usually made smaller than the second or subsequent doses. The record of cases shows that inoculation fever begins about the eighth or ninth day after inoculation. This fever persists for from 7 to 8 days. Occasionally it may not be noticeable for more than 4 days, and sometimes it is prolonged to 15 days. The average daily temperature during the primary fever period is about 104½° F. Ordinarily a secondary-fever period occurred at about the twenty-fifth to the thirtieth day after inoculation, and continued for from 7 to 8 days. As a rule the secondary fever is not as severe as the first. Subsequent recurrences of fever are often noticed but are usually of a mild form.

Besides keeping a detailed record of changes in temperature of the experimental animals, the authors made records of the variation in red blood corpuscles by means of a hematocrit. In one lot, consisting of 6 head of animals, the average percentage of red blood corpuscles in the blood at the beginning of the experiment was 38.3. On the eighth day after inoculation the percentage had fallen to an average of 31.3. The destruction of blood corpuscles continued until on the fifteenth day of the experiment the percentage was 23.3. On the nineteenth day after inoculation, the temperatures were normal and the percentage of red blood corpuscles began slowly to increase.

During the inoculation fever certain physiological disturbances are noticed, among which may be mentioned a lack of relish of food, occasional bloating, disposition to eat dirt, muscular weakness, and trembling. In the lot of animals which was last mentioned, the hematocrit readings showed the lowest average percentage of red blood corpuscles on the thirty ninth day after inoculation. This occurred during the secondary fever period which began on the twenty-eighth day of the experiment. The lowest percentage of red blood corpuscles recorded on the thirty-ninth day was 14 per cent, and the highest 26 per cent, with an average of 21 per cent. In this same lot of animals a second inoculation was made on the seventy-seventh day of the experiment. The fever reaction was mild and there was only a slight destruction of red blood corpuscles. A third inoculation was made on the one hundred and thirty-second day of the experiment. The reaction from this inoculation was exceedingly slight. The first inoculation of this lot was made on January 7, 1899. The cattle were infested with the young ticks on May 5, 6, and 27. During June and July they carried fever ticks, but the ticks were not present on them in great numbers until August. On August 31 this experiment was closed, the temperature and average percentage of red blood corpuscles being normal at the time.

These experiments indicate that the diminution in red blood corpuscles corresponds closely in time to the rise of temperature, but it continues for a time after the temperature begins to fall. During the interval between the primary and secondary fever periods the percentage of red blood corpuscles rises, but falls again during the secondary-fever period. The authors conclude that "the recovery from the fever and the maintenance of an immune condition depend upon the ability of the animal (1) to keep in check the growth of the micro-parasites, (2) to supply new corpuscles as rapidly as they are destroyed, and (3) to remove waste products rapidly." Young animals withstand the inoculation fever far better than older ones. The most suitable age is from 8 to 12 months. Animals which are older than 12 months suffer severely from the inoculation fever and may die from a relapse, and if young calves are inoculated too soon after weaning, the digestive disturbances are apt to prove fatal in connection with the inoculation fever. Young calves may be safely inoculated, however, if allowed to remain with the cows.

The blood used in these experiments was taken from two sources, from naturally immune Southern cattle and Northern cattle made immune by tick infestation or blood inoculation. It was noticed that the virulence of the blood from different sources and from the same animal under different conditions may sometimes vary. It is, therefore, perhaps advisable to use blood from animals which have become thoroughly immune to the disease, since their blood will possess a more uniform virulence. The blood should be used when perfectly fresh. When blood for immunization is used from tick-infested animals, from 1 to 2½ cc. constitutes a sufficiently large dose.

The authors urge the advisability of maintaining a close watch upon the digestive functions of the animals during the period of immunization. It is necessary that the animals should be fed upon a highly nutritious diet, and it is desirable that the diet should be such as to maintain a lax condition of the bowels. Inoculation may be made at any season of the year, but in general it is advisable to choose seasons when the animals will not suffer from either too great cold or heat. Cattle may be safely inoculated in the South if they are kept free from ticks for about 60 days after inoculation, A few fatal relapses will occur, however, after the animal has become apparently immune, but these relapses may be prevented in large measure by careful feeding and by preventing unusual excitement of the inoculated animals. The process of immunization in Northern animals is probably such a gradual one that they should not be considered entirely immune until they have been kept one year in the South and subjected to tick infestation.

Inoculation to produce immunity from Texas fever in Northern cattle, E. C. SCHROEDER (*U. S. Dept. Agr., Bureau of Animal Industry Rpt. 1898, pp. 273-288*).—The object of these experiments was to confirm the belief that a mild attack of Texas fever in Northern cattle would confer immunity against the disease. Each animal was given a hypodermic injection of blood drawn from the jugular vein of an immune Southern cow. The injections were made during the fall and winter and the cattle were exposed in the South during the following spring. The total number of animals which received injections was 11. Of this number, 9, together with 4 other cattle and 5 checks, were subsequently exposed to Texas fever in Virginia. Detailed records are given of the reaction and behavior of the cattle during the exposure. Of the 11 injected cattle 9 were exposed to Texas fever in permanently infected territory. One of the two older cattle which received an injection suffered a mild attack of Texas fever. The remaining animals which received injections escaped the disease entirely or suffered only a very mild form of the disease. Of the 5 check animals, 4 died, and the remaining one which survived suffered from a severe attack of Texas fever.

Blackleg in the United States and the distribution of vaccine by the Bureau of Animal Industry, V. A. NÖRGAARD (*U. S. Dept. Agr., Bureau of Animal Industry Rpt. 1898, pp. 27-81, pl. 1, map 1, figs. 3*).—A preliminary report upon blackleg has already been noted (E. S. R., 10, p. 396). The detailed account which is given in the present paper is mainly based upon an outbreak of blackleg which occurred in Texas. During the 18 months covered by this report about 500,000 animals have been injected with vaccine sent out from the Bureau of Animal Industry, and loss from blackleg has been reduced to less than one-half per cent. A map is given which shows the distribution of blackleg in the United States and indicates the extent of the use of vaccine in different parts of the country.

The author states that blackleg vaccine may be manufactured for less than 1 cent per dose, and that the cost of production in the Bureau of Animal Industry does not exceed 1 cent per 10 doses. A detailed account is presented by way of historical review of our knowledge of blackleg. This disease occurs in nearly all the countries of the world. In the United States it is especially serious in Texas, Indian Territory, Oklahoma, Kansas, Nebraska, Colorado, North Dakota, and South Dakota.

The disease more frequently attacks animals between the ages of 6 and 18 months. Statistics collected in Switzerland indicate that 82 per cent of all cases occurred among cattle of ages varying from 6 months to 2 years. It has been claimed that the range cattle in Hungary are practically immune to blackleg. Similar claims have been made for the cattle of Algeria. In the United States it has been noticed that common range cattle are less susceptible than graded stock, and since it is probable that infection occurs by means of abrasions of the skin, it seems that in general thick skinned animals are less susceptible than more thin-skinned ones. Statistics do not indicate any striking difference in the susceptibility of the 2 sexes to blackleg, except perhaps among older animals, where it would appear that males are more susceptible. The spring and fall seasons are apparently most favorable for the development of the disease. Detailed accounts are given of the symptoms and of the pathological conditions to be found upon *post-mortem* examination.

The blackleg bacillus is described and an account is given of the biology of the organism and of the manner of its entrance into the body as already indicated.

Most cases of blackleg prove fatal. In reply to circulars, 120 stock owners out of 522 stated that they have seen animals recover from this disease, the number of reported recoveries amounting to 185. Since treatment is of little avail, the principal resource against this disease is prevention. Preventive measures may be classified as hygienic and prophylactic. Among the hygienic measures may be mentioned thorough disinfection of infected premises, and the careful burying or destruction of carcasses of animals dead of this disease. Some stock owners reported that blackleg never caused serious losses where it was possible to burn over the pastures regularly in the winter. The author discourages the use of seton or rowel in attempting to prevent an attack of blackleg.

An account is given of the different methods which have been proposed for the preparation of the preventive vaccine. At first 2 vaccinations were used, the first being with a mild and the second with a stronger virus. Later it was found possible to use a stronger virus at first and only one vaccination. In the Bureau of Animal Industry the finely ground and sifted blackleg meat is heated for 6 hours at a temperature of 93 or 94° F. This process was found to produce a virus of the desired strength. Detailed directions are given for the sterilization of injection apparatus and the preparation and use of the vaccine.

The diagnosis of glanders, V. M. SULIN (*Arch. Vet. Nauk, St. Petersburg, 29 (1899), No. 9, pp. 454–473*).—A number of experimental inoculations of mallein were made both with healthy and glanderous horses. The object of the experiments was to determine the variation in the number of white blood corpuscles under the influence of mallein. The results of this investigation may be stated as follows: The leucocytes possess a greater significance in the young than in adult horses, and the least significance in old horses. In healthy horses the fluctuation in the number of leucocytes is insignificant. A much greater fluctuation is to be observed in glanderous horses. In healthy horses the number of leucocytes undergoes no change after injection with mallein, or, if a variation is observed, it has no connection with the action of the mallein. In glanderous horses, after the mallein injection, there is always a greater or less decrease in the number of leucocytes. This process is observed most frequently about 6 hours after the injection, and more often earlier than later. Following this process there is always an increase in the number of leucocytes. Both of these processes take place even in case of an already existing leucocytosis. The appearance of leucocytosis is not synchronous with the elevation of temperature, but may be either earlier or later. Leucocytosis and aleucocytosis occur also in such glanderous horses as do not react to the mallein by a rise in temperature. The author also investigated the question of the relationship of the different kinds of leucocytes to one another and of the relative fluctuation of their numbers under the influence of mallein.

Heart-water experiments, R. W. DIXON (*Agr. Jour. Cape Good Hope, 15 (1899), No. 12, pp. 790–792*).—Heart water is a contagious disease of sheep and goats which is probably carried from animal to animal by means of the ticks. The author undertook a number of experiments in inoculation of sheep and goats for the purpose of producing immunity against the disease. The method of inoculation was with defibrinated virulent blood. The length of immunity conferred by this method was from 1 to 2 months. The author recommends that stringent methods be adopted for the destruction of the ticks, and suggests that by repeated spraying with paraffin and solution of arsenic or some other similar insecticide, the number of the ticks might be so reduced as to materially diminish the prevalence of heart water among sheep.

Notes on roup in fowls, J. BARLOW (*Rhode Island Sta. Rpt. 1898, pp. 97–105*).—In this article the author gives a general description of the symptoms of the disease in fowls, with a discussion of the literature bearing upon the subject. It is stated that in certain parts of the State the disease causes large losses to poultry raisers every year. Consideration is given to the question of the relationship between roup of fowls and diphtheria of human beings, and also of the question of the contagiousness of roup. Instances are cited from the literature of roup in which the disease seemed to be transmitted from fowls to man and from man to fowls. In order to determine the method of contagion, experiments were made in applying portions of the discharge from diseased fowls to the eyes of healthy fowls. After 10 days the disease was manifested. Healthy fowls were also shut up with diseased ones and made to eat and drink from the same receptacles. In these cases also the healthy fowls soon acquired the disease.

In the treatment of roup the author insists upon the importance of immediately isolating all diseased poultry, and believes that fowls which have once had the disease should not be afterwards used for breeding. The diseased fowls should be placed in comfortable quarters and should receive plenty of food. The exudate of membranous material formed in the throat or nostrils may be removed, and antiseptic washes, such as dilute carbolic acid, a 1 to 2,000 solution of corrosive sublimate, and peroxid of hydrogen in 3 per cent aqueous solution may be used with good results.

Asthenia (going light) in fowls, C. F. DAWSON (*U. S. Dept. Agr., Bureau of Animal Industry Rpt. 1898, pp. 329–333, pl. 1*).—An outbreak of a fowl disease having occurred in Hyattsville, Md., a few fowls were brought to the Bureau of Animal Industry for investigation The disease was a chronic one, lasting about 3 months before a fatal issue. Upon making *post-mortem* examination, it was found that the duodenum was the only organ which was noticeably affected, the lining of this part of the intestine showing a catarrhal condition. Cultures were made from the contents of the duodenum with the result that a single species of bacterium was found. Hypodermic inoculations of pure cultures of this organism in a guinea pig produced death within 24 hours. A *post-mortem* examination of the guinea pig revealed the presence of the germ in lesions of the liver, spleen, and lungs. A description is given of the organism under the name of *Bacterium astheniæ*, and an account is presented of the behavior of the organism upon various culture media. This organism has the power of vegitating within wide temperature limits, from 50 to 120° F. A freezing temperature for 24 hours did not kill it. Two weeks' drying in diffused sunlight was not fatal to it.

As treatment for this disease of fowls, the author recommends purgation with castor oil in two-teaspoonful doses or calomel in repeated $\frac{1}{4}$-grain doses; purgation to be followed with tonic treatment.

The rôle of insects, Arachnids and Myriapoda, as carriers of human and animal diseases which are produced by bacteria and animal parasites, G. H. F. NUTTALL (*Hyg. Rundschau, 9 (1899), Nos. 5, pp. 209–220; 6, pp. 275–289; 8, pp. 393–408; 10, pp. 503–520; 12, pp. 606–620*).—In this series of articles the author presents an elaborate digest of the literature of the subject in connection with a bibliography of nearly 300 titles. Among the numerous special subjects treated in these articles, we may mention the following: The transmission of anthrax by flies (Tabanus, Hæmatopota, Musca, Stomoxys, etc.), beetles and Cimex and Pulex; the transmission by various insects of the organisms of hog cholera, chicken cholera, erysipelas, recurrent fever, yellow fever, and typhus; the transmission of tuberculosis by *Musca domestica* and *Acanthia lectularia;* the agency of various species of Ixodes in carrying contagious diseases; the transmission of contagious diseases by *Sarcopsylla penetrans,* species of Trombididæ, and various round and flat worms; and a discussion of the relationship of the cattle tick to the transmission of Texas fever.

Report of the State veterinarian, L. PEARSON (*Pennsylvania Dept. Agr. Rpt. 1898, pt. 1, pp. 151–187*).—A report of work on the following diseases: Rabies, anthrax, cornstalk disease, hog cholera, tuberculosis, glanders, blackleg, abortion, milk fever, Texas fever, lungworm disease, cowpox, and dysentery of calves.

Report of the veterinary division, J. A. GILRUTH (*New Zealand Dept. Agr. Rpt. 1899, pp. 60–91, pls. 9*) —This report presents an account of a supposed outbreak of contagious pleuro-pneumonia, of the prevalence, spread, and methods of control and extermination of tuberculosis, with reports on tuberculin tests, actinomycosis, parasitic gastritis in calves, red water, milk fever, cirrhosis of the liver, and bacteriological examinations for the dairy service.

Report of government veterinarian, A. PARK (*New Zealand Dept. Agr. Rpt. 1899, pp. 115–122*).—This report contains an account of a large number of tuberculin tests, with an account of the *post-mortem* findings in condemned animals.

Report of government veterinarian, C. J. REAKES (*New Zealand Dept. Agr. Rpt. 1899, pp. 122–132, pl. 1*).—The author presents notes on the "Winton" disease of horses, actinomycosis, milk fever, tuberculosis of cattle and of pigs, and swine fever.

Contagious diseases of animals in European countries (*U. S. Dept. Agr., Bureau of Animal Industry Rpt. 1898, pp. 428–439*).—A statistical account of the prevalence in the various European countries of contagious pleuro-pneumonia, foot-and-mouth disease, swine fever, rabies, glanders, sheep pox, scab, hog cholera, blackleg, anthrax, etc.

The reaction of the lymphatic glands to micro-organisms, G. PEREZ (*Ann. Ig. Sper., n. ser., 8 (1898), No. 1, pp. 1–103*).—An elaborate series of experiments with inoculations of pathogenic organisms in dogs, guinea pigs, and rabbits.

Influence of the lymphatic glands in the production of immunity, L. MANFREDI and P. VIOLA (*Ann. Ig. Sper., n. ser., 8 (1898), No. 4, pp. 456–489*).—The lymphatic system is endowed with a high resisting power against anthrax, typhus, and diphtheria, and plays an important rôle in immunization.

Lupines as plants poisonous to stock, E. V. WILCOX (*Jour. Comp. Med. and Vet. Arch., 20 (1899), No. 13, pp. 766–774*).—A brief discussion of cases of stock poisoning from lupins, with a bibliography.

Studies on anthrax, O. CASAGRANDI (*Ann. Ig. Sper., 9 (1899), No. 2, pp. 212–234*).

Actinomycosis, J. B. WRIGHT (*Jour. Comp. Med. and Vet. Arch., 20 (1899), No. 12, pp. 758–763*).—A discussion of the pathological anatomy of the disease in cattle, swine, sheep, and horses, with mention of the iodid of potash treatment and preventive measures.

The excretion of tetanus virus by the kidneys, S. J. GOLDBERG (*Centbl. Bakt. u. Par., 1. Abt., 26 (1899), No. 18–19, pp. 547, 548*).—The author conducted experimental investigations upon rabbits and guinea pigs. It was found, as a result of these experiments, that tetanus virus was not present either in the excretion from the kidneys or in the amniotic water of these animals.

The composition of the tuberculosis and glanders bacilli, E. A. DE SCHWEINITZ (*U. S. Dept. Agr., Bureau of Animal Industry Rpt. 1898, pp. 295–300*).—Reprinted from the American Chemical Journal for August, 1895. The elementary and proximate composition are given, and the data discussed in comparison with the work of others.

Notes upon the fats contained in the tuberculosis bacilli, E. A. DE SCHWEINITZ and M. DORSET (*U. S. Dept. Agr., Bureau of Animal Industry Rpt. 1898, pp. 301, 302*).—Reprinted from the Journal of the American Chemical Society for May, 1896 (E. S. R., 8, p. 104).

The mineral constituents of the tubercle bacilli, E. A. DE SCHWEINITZ and M. DORSET (*U. S. Dept. Agr., Bureau of Animal Industry Rpt. 1898, pp. 302–304, pls. 2*).—Reprinted from the Journal of the American Chemical Society (E. S. R., 10, p. 1016).

A new stain for Bacillus tuberculosis, M. DORSET (*U. S. Dept. Agr., Bureau of Animal Industry Rpt. 1898, pp. 326–328*).—Since the tubercle bacillus has been shown to contain about 40 per cent of material which is soluble in ether, it was decided to try Sudan III as a stain, this stain being especially recommended for fatty material. Cover glass preparations were made and then immersed for 5 minutes in a saturated solution of Sudan III in 80 per cent alcohol. This stain gave excellent results. The same stain used in pure cultures of hog cholera, glanders, typhoid, anthrax, symptomatic anthrax, diphtheria, and other organisms gave negative results. Sudan III is therefore considered a differential stain for the tubercle bacillus.

The relation of the farmer to bovine tuberculosis, V. I. SPEAR (*Rhode Island State Bd. Agr. Rpt. 1898, pp. 191–202*).—A popular discussion of the practical value of the tuberculin test and of means to be adopted in freeing herds from tuberculosis and preventing their reinfection.

Combating tuberculosis of man and animals in France and other countries, L. H. PETTIT and E. LECLAINCHE (*Rev. Tuberculose, Paris, 7 (1899), No. 4, pp. 355–373*).—Notes on the methods adopted in various countries in the reduction of tuberculosis.

Tuberculosis and how to eradicate it, J. M. CARTER (*Pennsylvania Dept. Agr. Rpt. 1898, pt. 1, pp. 340–346*).—A brief account of the distribution of tuberculosis which followed upon the breaking up and sale of a tuberculous herd.

Prevention of bovine tuberculosis, L. STUBBE (*Jour. Soc. Cent. Agr. Belg., 47 (1899), No. 2, pp. 61–66*).—Recommends the slaughter of animals with clinical symptoms of tuberculosis and of those which react to tuberculin, and the payment of an indemnity for such animals.

Experiments with the antitubercular serum of Maragliano, S. CRESCIMANNO (*Sieroterapia, 2 (1898), No. 11, pp. 126–128*).—This serum has curative action but does not protect the organism against subsequent infection by tuberculosis. The serum has no injurious effects upon the organism into which it is injected.

Some results in the treatment of tuberculosis with antituberculosis serum, E. A. DE SCHWEINITZ (*U. S. Dept. Agr., Bureau of Animal Industry Rpt. 1898, pp. 289–295*).—This article records the results of experiments upon human tuberculous patients with an antituberculosis serum prepared by the Bureau of Animal Industry. Of the 34 patients who were treated, 16 were in the incipient stage, 15 were moderately advanced, and 3 were far advanced. The physical signs, expectoration, temperature, cough, appetite, and weight were improved in the majority of cases. The experimental work thus far done on guinea pigs, and the results obtained by the use of the antituberculosis serum on man indicate that this serum obtained from horses possesses considerable value.

The cattle tick and tuberculosis in New South Wales, G. S. BAKER (*U. S. Dept. Agr. Bureau of Animal Industry Rpt. 1898, p. 386*).—A brief note on the great prevalence of the cattle tick in New South Wales and on the frequency with which tuberculous animals are used for meat.

A cattle disease in Marshall County, Kansas (*U. S. Dept. Agr., Bureau of Animal Industry Rpt. 1898, pp. 382–384*).—An outbreak of a disease which occurred at Blue Rapids, Kans., was investigated by R. P. Steddom. The disease is characterized as being essentially an inflammation of the external genital organs. The application of silver nitrate and a 5 per cent solution of creolin is reported as giving good results.

A cattle disease in Uruguay, A. W. SWALM (*U. S. Dept. Agr., Bureau of Animal Industry Rpt. 1898, p. 385*).—A brief note on veterinary regulations in Uruguay concerning Texas fever.

Cattle quarantine line, C. CURTICE (*North Carolina Sta. Spec. Bul. 52, pp. 28*).—This bulletin contains a copy of Order No. 24 of the Bureau of Animal Industry of this Department regarding cattle transportation, a statement of the North Carolina State laws regarding traffic in cattle, a proclamation of quarantine by the governor of North Carolina, a special order of the Secretary of Agriculture modifying quarantine line for the State, quotations from newspapers regarding cattle quarantine, a copy of the Virginia State law concerning cattle transportation, and a copy of an act to prevent the spread of cattle distemper or tick fever and other contagious or infectious diseases of live stock, which latter has been brought before the general assembly of North Carolina.

Concerning a disease of sheep, F. MERCANTI and S. DESSY (*Ann. Ig. Sper., n. ser., 8 (1898), No. 4, pp. 381–395*).—A study of the effects of toxic substances produced by intestinal worms in sheep.

Distomatosis, S. LYUDSKANOV (*Vet. Sbirka, 7 (1898), No. 4–5, pp. 73–86*).—Notes on *Distoma hepaticum* and *D. lanceolatum*, with an account of the symptoms, course, and prevention of the disease caused by their presence in sheep.

Experiments with lime and sulphur dip, A. G. DAVISON (*Agr. Jour. Cape Good Hope, 15 (1899), No. 13, pp. 843–845*).—It was found that the wool of Tasmanian sheep was not injured by this dip.

Feeding wild plants to sheep, S. B NELSON (*U. S. Dept. Agr., Bureau of Animal Industry Rpt. 1898, pp. 421–425*).—This paper is reprinted from Bulletin 22 of the Bureau (E. S. R., 10, p. 793).

Swine fever, J. A. GILRUTH (*New Zealand Dept. Agr. Rpt. 1899, pp. 92–115, pls. 3*).—A detailed account is given of outbreaks of this disease in different parts of New Zealand. The disease is considered the same as that known as hog cholera in this country. Numerous cultures were made of the specific organisms and a number of inoculation experiments were carried on with guinea pigs, rabbits, pigeons, and pigs. In these cases careful *post-mortem* examinations were made and the pathological conditions were observed and described in detail. It was found that in this disease pulmonary and pleural lesions may and frequently do occur independently of the characteristic bowel complications of swine fever. The author believes that it is doubtful whether hog cholera and swine plague will prove to be distinct diseases.

The production of immunity in guinea pigs from hog cholera by the use of blood serum from immunified animals, E. A. DE SCHWEINITZ (*U. S. Dept. Agr., Bureau of Animal Industry Rpt. 1898, pp. 269–272*).—Reprint of a paper read before the American Association for the Advancement of Science, in 1892.

Enzyms, or soluble ferments, of the hog cholera germ, E. A. DE SCHWEINITZ (*U. S. Dept. Agr., Bureau of Animal Industry Rpt. 1898, pp. 266–268*).—Reprint of an article read at the American Association for the Advancement of Science, in 1892.

The serum treatment for swine plague and hog cholera, E. A. DE SCHWEINITZ (*U. S. Dept. Agr., Bureau of Animal Industry Rpt. 1898, pp. 235–248, pls. 2*).—This report is essentially the same as that contained in Bulletin 23 of the Bureau (E. S. R., 11, pp. 89, 90).

Experiments in stamping out hog cholera in Page County, Iowa (*U. S. Dept. Agr., Bureau of Animal Industry Rpt. 1898, pp. 249–265*).—This is a statistical account of the work done on hog cholera in Iowa (E. S. R., 11, pp. 89, 90).

Partial paralysis and crippling of swine, J. H. REED and G. E. DAY (*Rpt. Agr., New Brunswick, 1899, pp. 310–315*).—Notes on the symptoms and treatment of this disease.

The germicide value of acrolein, E. KOCH and G. FUCHS (*Centbl. Bakt. u. Par., 1. Abt., 26 (1899), No. 18-19, pp. 560-563*).—Acrolein in its chemical constitution is distinctly related to formalin. In the experiments which were undertaken by the author, this substance was found to be even more effective than formalin in destroying bacteria.

A new method for the disinfection of stalls, R. WALTHER and A. SCHLOSSMANN (*Ztschr. Tiermed., 2 (1898), No. 4, pp. 269-279, fig. 1*).—An apparatus was employed which filled the stall with a mist of glycoformal, which is composed of 60 parts of water, 30 parts of formol, and 10 parts of glycerine.

Disinfection, E. A. A. GRANGE (*Jour. Comp. Med. and Vet. Arch., 20 (1899), No. 11, pp. 674-680*).—A discussion of the value of various substances for this purpose.

Stable disinfection, J. B. PAIGE (*Rhode Island State Bd. Agr. Rpt. 1898, pp. 213-222*).—The author discusses the natural and artificial remedies which are to be relied upon for disinfecting stables. The disinfectant agencies which are discussed are sunlight, dry and moist heat, carbolic acid, creolin, lysol, disinfektol, corrosive sublimate, sulphur dioxid, and chlorin gas.

Contribution to a study of the disinfecting power of common soap, A. SERAFINI (*Ann. Ig. Sper., n. ser., 8 (1898), No. 2, pp. 199-221*).—Both soda and potash soaps possess considerable antiseptic power. A bibliography of the literature of this question is added to the article.

Cooperation between the experiment station veterinarian and the local veterinarian, A. W. BITTING (*U. S. Dept. Agr., Bureau of Animal Industry Rpt. 1898, pp. 426, 427*).—This is a reprint from Bulletin 22 of this Bureau (E. S. R., 10, p. 793).

STATISTICS—MISCELLANEOUS.

Fourteenth Annual Report of Maine Station, 1898 (*Maine Sta. Rpt. 1898, pp. 242*).—This contains the organization list of the station; a brief report by the director; list of acknowledgments; reprints of Bulletin 41, Dehorning cows (E. S. R., 10, p. 395), and Bulletin 42, Ornamenting home grounds (E. S. R., 10, p. 355); abstracts of Bulletins 43-45; reprints of Bulletin 46, Some ornamental plants for Maine (E. S. R., 10, p. 855), and Bulletin 47, Wheat offals sold in Maine in 1898 (E. S. R., 10, p. 1089); miscellaneous articles noted elsewhere; and a report of the treasurer for the fiscal year ended June 30, 1898.

Eleventh Annual Report of Rhode Island Station, 1898 (*Rhode Island Sta. Rpt. 1898, pp. 75-240*).—This includes the organization list of the station; a report of the director giving a summary account of the principal lines of investigational work carried on during the year, with notes on the staff, equipment, and publications of the station; departmental reports containing a number of articles abstracted elsewhere; lists of donations, exchanges, and the publications of the station since 1888; and an index to the report and Bulletins 47-51 issued during the year. The financial statement for the fiscal year ended June 30, 1898, is given in the report of the college, p. 90.

Eighth Annual Report of Washington Station, 1898 (*Washington Sta. Rpt. 1898, pp. 8*).—This contains the organization list, a brief report by the director reviewing the station work for the year, and a financial statement for the fiscal year ended June 30, 1898.

Fifteenth Annual Report of the Bureau of Animal Industry, 1898 (*U. S. Dept. Agr., Bureau of Animal Industry Rpt. 1898, pp. 647, pls. 26, figs. 69*).—This contains the report of the chief of the Bureau, a number of articles noted elsewhere, abstracts of some 20 station bulletins reporting investigations along lines embraced in animal industry, and extracts from consular reports and from correspondents. The report also contains statistics of the movement of farm animals, range or average price of farm animals at Chicago for 1897 and 1898, imports and exports of animals and animal products and the number and value of farm animals for the same years. A list of State live stock sanitary boards, secretaries of State boards of health, and State [illegible] having control of contagious and infectious diseases among domestic animals is given, and the rules and regulations of the Bureau issued in 1897 and 1898 are quoted.

Experiment Station Work—XIII (*U. S. Dept. Agr., Farmers' Bul. 107, pp. 32, figs. 2*).—This number contains articles on the following subjects: Fertilizer requirements of crops, persimmons, forcing rhubarb, grinding corn for cows, waste in feeding cornstalks, molasses for farm animals, feeding ducks, cost of raising calves, feeding calves with milk of tuberculous cows, killing the germs of tuberculosis in milk, [illegible] milk and cream, and dairy salt.

Farmers' reading courses, L. H. BAILEY (*U. S. Dept. Agr., Office of Experiment Stations Bul. 72, pp. 36*).—Farmers' reading courses in the United States have been largely organized and engineered by the agricultural colleges and experiment stations of the different States. Their object is to bring within the reach of farmers opportunity for securing systematic instruction under the direction of competent men on subjects affecting farm interests and farm life. The present bulletin treats of the historical development and present status of these courses in America. Outlines of the reading courses as conducted by agricultural colleges in Ontario, Pennsylvania, Michigan, New Hampshire, Connecticut, New York, West Virginia, and South Dakota are given with lists of the books used and mention made of ventures along the same lines in other States. In the appendix samples of lesson [illegible] and question papers issued in connection with the reading courses in some of the different States are given as are also samples of membership cards, application blanks for membership, etc. The different courses are commented upon and special features of the different systems pointed out and suggestions given regarding the conduct and management of farmers' reading courses.

Farmers' reading courses (*U. S. Dept. Agr., Farmers' Bul. 109, pp. 20*).—This is an abridgment of the above bulletin.

Books for farmers, stockmen, dairymen, and fruit growers, J. B. REYNOLDS (*Ontario Dept. Agr., pp. 8*).—Notes are given on the value and use of a farm library, and some 30 books on agricultural topics are recommended for this purpose and their contents summarized.

Agriculture and dairying in Scotland, J. C. HIGGINS (*U. S. Dept. Agr., Bureau of Animal Industry Rpt. 1898, pp. 213–223*).

Rise and growth of agricultural education, J. D. WALTERS (*Industrialist, 26 ([illegible]), No. 24, pp. 327–334*).—The rise and development of agricultural colleges, experiment stations, and farmers' institutes in the United States are discussed.

Botanical institutions and the agricultural organization of Java and Ceylon, G. CLAUTRIAU (*L'Ing. Agr., 10 (1899), Nos. 4, pp. 301–328; 5, pp. 345–374*).

Report on crops, live stock, etc., in Manitoba (*Dept. Agr. and Immig. [Manitoba] Bul. 60, pp. 12*).—A brief summary of the yield of the various crops of the Province in 1899, data on dairy products and live stock, and the rainfall for each month from April to October.

Farm animals in Denmark, 1898 (*Ugeskr. Landm., 44 (1899), No. 35, p. 440*).—According to a recent bulletin of the Statistical Bureau the number of farm animals in Denmark, July 15, 1898, was as follows: Horses, 449,264; cattle, total, 1,743,440 (bulls and steers, 111,186; milch cows, 1,067,138; heifers and calves, 565,116); sheep, 1,074,413; goats, 31,803; swine, 1,178,514. Poultry: Chickens, 8,748,428; turkeys, [illegible]2; ducks, 803,217; geese, 210,907. Rabbits, 81,475; number of beehives, 118,178.—[illegible] WOLL.

American animals and animal productions in Great Britain, W. H. BRAY (*U. S. Dept. Agr., Bureau of Animal Industry Rpt. 1898, pp. 440–462*).—This includes data and discussion relative to the importation of cattle and horses into Great Britain, rules for the London provision trade, average weights of provision packages, prices of animal products in London, and an account of the cheese trade with the United Kingdom.

NOTES.

MISSOURI STATE FRUIT EXPERIMENT STATION.—This station was established by an act of the last State legislature, which appropriated $15,000 for the purpose for two years. A commission appointed by the governor to select a suitable site decided upon the town of Mountain Grove, which is practically in the center of the Ozark country. The town of Mountain Grove donated 198 acres of land for the use of the station. Active operations were not commenced until the beginning of the present year, so that the total appropriation of $15,000 is available for this year's work. J. T. Stinson, formerly horticulturist of the Arkansas Station, was elected director. Over 10 acres of land have been planted in fruits and berries the past spring. The contract has been let for the erection of the buildings, which will consist of an office and laboratory building, residences for the director and for the foreman, and a barn. The station is under the control of a board of trustees appointed by the governor. This board consists of J. C. Kerby, president, West Plains; M. T. Davis, treasurer, Aurora, and L. O. Hailey, secretary, Ava.

NEW MEXICO COLLEGE AND STATION.—John J. Vernon, formerly assistant horticulturist of the Iowa Station, has been appointed agriculturist and horticulturist in the college and station, and entered upon his duties May 1.

OHIO STATION.—The last general assembly enacted a law providing for the inspection of nurseries and orchards in the State for the San José scale, black knot, peach yellows, and other dangerous insect and contagious diseases of trees, shrubs, vines, etc., and the compulsory treatment of infected orchards, or their destruction when necessary. The station is charged with the enforcement of this law, and an appropriation of $15,000 was made for this purpose during the two years 1900 and 1901. Lowell Roudenbush has been appointed horticultural inspector and will have immediate supervision of the work. The following appropriations were made by the general assembly for the two years 1900 and 1901: Expenses of board of control, $1,200; bulletin illustration, $800; substations for field experiments, $4,200; special work in entomology, botany, chemistry, and horticulture, $7,500; investigation and prevention of tuberculosis and other diseases of cattle, $6,000; general repairs, labor, and supplies, $7,000; new construction, $4,850. Total, $31,550.

SOUTH CAROLINA COLLEGE AND STATION.—A. P. Anderson, who several years ago was botanist in the college and station, has been elected entomologist, and will enter upon his duties June 1. A. T. Smythe, of Charleston, has been added to the station committee.

TEXAS COLLEGE.—The summer school, which opens at the college June 18, will include among others courses in agriculture, horticulture, and manual training. The courses will continue for six weeks and are open to both sexes.

MISCELLANEOUS.—According to a recent number of Science, "An International Congress of Meteorology is to be held at Paris from September 10 to 16 of the present year. The president of the Commission d'Organisation of the congress is M. Mascart, director of the Central Meteorological Bureau of France. The secretary is M. Angot. Membership in the congress may be had on payment of 20 francs. The preliminary programme includes a long list of subjects in meteorology proper, as well as in oceanography and terrestrial magnetism and electricity."

A botanical garden and experiment station has been established at Coquilhatville, in the Congo Free State.

EXPERIMENT STATION RECORD.

VOL. XI. NO. 11.

Within the past few months the agricultural colleges and experiment stations of this country have lost by death two of their most able friends and supporters, who for many years had been actively associated with their work. Both were influential in securing the national legislation leading to the establishment of the experiment stations, and each served with distinction for a term as president of the Association of American Agricultural Colleges and Experiment Stations, in the proceedings of which they took an active part from the first.

James Henry Smart, who died February 21 at the age of 59 years, had been engaged in various lines of educational work for over forty years. He served successively as teacher in the public schools of New Hampshire, his native State, principal of a school at Toledo, Ohio, and superintendent of schools at Fort Wayne, Ind., occupying the latter position for a period of ten years. From 1874 to 1880 he was superintendent of public instruction in Indiana, during which time he revolutionized the school system of that State, and placed it in the front rank of American school systems. His association with agricultural education commenced with his election to the presidency of Purdue University in 1883, which he occupied with signal ability until his death.

Dr. Smart took a deep interest in the colleges of agriculture and mechanic arts and the agricultural experiment stations, and he thoroughly appreciated the value of these institutions in the educational system of the country and for the general uplifting and advancement of agriculture. He was one of the leading advisers in the framing of the Hatch Act, providing for the establishment of the stations, and he took an important part in securing the passage of the Morrill Act of 1890, increasing the support of the colleges.

At two different times Dr. Smart served as director of the Indiana Station, and at all times he evinced a deep interest in its work and in bringing the results of its teachings home to the farmer.

Although nearly blind for the last few years of his life, with the aid of an assistant he kept remarkably well informed of events in the educational world, and when his health permitted he continued his college work with indomitable courage and energy. To his tireless energy and wise judgment is largely due the development of a weak and struggling institution, with a small attendance, into one of the largest and most prosperous technical schools in the country, with greatly increased endowment, superior equipment, and an attendance of over 800 students from different parts of the United States.

George Espy Morrow, who died at Paxton, Ill., March 27, 1900, was one of the pioneers in work in agricultural education and research in this country. Practically his entire mature life was devoted to the advancement of agriculture. Early in his career he was engaged for some ten years in editorial work, being connected with a number of different agricultural papers during that time. In 1876 he accepted the position of professor of agriculture in the Iowa Agricultural College, but he occupied the chair only a few months before he was elected to a similar professorship in the Illinois Industrial University (now the University of Illinois). The latter position he occupied for nearly eighteen years. On the organization of the experiment station in 1888 he was made agriculturist and a member of its board of direction. He was president of this board of direction from 1892 to 1894, which placed him in charge of the executive work of the station.

In 1894 Professor Morrow assumed the presidency of the Oklahoma Agricultural College, and the following year he was also made director of the experiment station connected with the college. He served in this dual capacity until failing health compelled his retirement from active service in 1899. He then went to his farm at Paxton, Ill., where the remaining months of his life were spent.

Professor Morrow was a voluminous writer, especially on agricultural subjects, and through this medium and his farmers' institute work, to which he was peculiarly suited, he exerted a very marked influence for the improvement of methods of agriculture in Illinois. His presidential address before the Association of American Agricultural Colleges and Experiment Stations in 1894 was the beginning of a deeper interest in the method of teaching agriculture. He there urged the importance of so systematizing the subject as to reduce it to a better pedagogical form, and commended this work to the association as one of the most useful and far-reaching which it could take up. Since that time there has been some consideration of the subject at nearly every meeting, resulting finally in the appointment of a special committee, which has made several valuable reports.

Some of Professor Morrow's most effective work was done near the close of his career, in Oklahoma. The present prosperous condition of the agricultural college and experiment station of that Territory and the era of good feeling toward the institution are very largely attributable to his influence and labors. Not only did he materially strengthen the institution itself, but he stimulated an interest in higher education, a pride in the agricultural college, and a popular sentiment for its liberal support and freedom from political interference. He left behind him there an impression which will be felt for many a day.

RECENT WORK IN AGRICULTURAL SCIENCE.

CHEMISTRY.

Chemical methods for ascertaining the lime requirements of soils, H. J. WHEELER, B. L. HARTWELL, and C. L. SARGENT (*Jour. Amer. Chem. Soc., 22 (1900), No. 3, pp. 153–177*).—Various methods proposed for the determination of the acidity of soils are discussed, and tests of a number of them are reported.

The methods tested and the conclusions reached are as follows:

"(1) Moistening the soil with water, then bringing it in contact with blue litmus paper and noting with what rapidity and to what extent it reddens the paper as compared with some soil whose character is already well known. This method is highly effective in the hands of a close observer who has had much experience in testing soils of known character.

"(2) Treatment of the soil with water to which a little ammonium hydroxid (ammonia water) has been added and noting whether, after settling, the liquid has assumed a dark brown or black appearance. This test applies only where the acidity is due in a considerable measure to acid organic substances. It may not apply in all sections of the country, as shown by Snyder, in Minnesota, but it has thus far proved a very useful and reliable test with Rhode Island and certain other New England and New York soils containing considerable quantities of humus. Gravimetrically applied, this is the method of Müntz.

"(3) The method employed by Holleman for determining the lime requirement of stiff clay soils in Holland, based upon the amount of lime (calcium oxid) removable by extracting with carbonated water. This method has given little promise of usefulness in testing our upland acid soils.

"(4) The method of Tacke for determining the relative acidity of peat (moor) soils of North Germany based upon the amount of carbon dioxid which the acid ingredients of the soil can expel from calcium carbonate at ordinary temperatures in an atmosphere of hydrogen. This method has not seemed to be applicable to our acid upland soils.

"(5) The determination of the total humus by a modification of the Grandeau method, which consists in removing the lime and magnesia from their combinations with the humus by treatment with dilute hydrochloric acid, and then dissolving the humus in ammonium hydroxid (ammonia water) and estimating the amount dissolved. In our granitic soils containing considerable quantities of humus, this method gives results standing in somewhat definite relation to the lime requirements.

"(6) Determinations of the amount of lime (calcium oxid) which can be dissolved by weak hydrochloric acid by digestion at a high temperature for several hours (official method of the Association of Official Agricultural Chemists). This method furnishes no reliable basis for arriving at the lime requirement of our acid upland soils.

"(7) Method by titration, based upon measuring the number of milligrams of nitrogen combined as ammonium salts and held by the soil when it is treated in a given way and for a given time with a very dilute solution of ammonium hydroxid.

"The results by this method agree more closely with the crop tests than by any other method tried, though it is closely approximated to, by the gravimetric determination of the humus dissolved from the soil by extraction with ammonium hydroxid without the previous removal of the lime and magnesia.

"(8) Method based upon the comparison of the color of the extract made from soils by treating directly with ammonia water, with the color of such an extract prepared from a like quantity of soil of known character. It seems probable that where the acidity is due largely to acid organic substances this method may give fairly good results The rapidity with which tests may be made by it is an important practical point in its favor as compared with the method as proposed by Müntz.

"(9) Method based upon the amount of carbon dioxid expelled by a given amount of soil from calcium carbonate when the two are heated together at the boiling point in the presence of water. This method gives promise of much value if the period of heating is made uniform and very brief, and if the carbon dioxid liberated is easily and accurately determined."

Phosphates and the humic acid method, W. HOFFMEISTER, (*Landw. Vers. Stat., 52 (1899), No. 5-6, pp. 329-345*).—The author reports studies with various slags, which indicate that his humic acid method (E. S. R., 10, p. 818) furnishes a reliable means of determining the relative value of different phosphates. In this method phosphoric acid goes into solution in combination with alkalis, while the lime separates out largely in the form of carbonates or humates. This reaction occurs most readily in those phosphates in which the lime is most easily thrown out of combination, namely, in superphosphates and Thomas slag. A considerable amount of silicic acid always passes into solution with the phosphoric acid, and it appears that the solubility of the latter increases with that of the former, so that more phosphoric acid is dissolved when fresh sand (which contains some soluble silica) is used in carrying out the method. The author believes that the soluble silicic acid of the soil is an important factor in determining the availability of phosphates applied as fertilizers, and suggests that the supply of soluble silica may become periodically exhausted. Several soils were examined by the method with results which indicated that in connection with pot experiments with fertilizers it will prove useful for determining the availability of the fertilizing constituents of the soil.

More specific directions than were contained in the previous article regarding the treatment of the humic acid extract are given as follows: The extract is made up to 2.5 liters. Two liters of the solution, corresponding to 4 gm. of Thomas slag, is filtered, evaporated to dryness, taken up in water, and again evaporated in order to drive off any ammonium carbonate that may be present. The residue is dissolved in hydrochloric acid, the solution evaporated to dryness, dilute hydrochloric acid added, and the solution filtered. An aliquot part of this solution is boiled with nitric acid and the phosphoric acid precipitated by the usual method.

Analysis of portion of ash of excrements insoluble in hydrochloric acid, P. SCHWEITZER (*Missouri Sta. Rpt. 1898, pp. 86, 87*).—**That portion of the ash of feces from steers fed timothy hay which was insol-**

able in hot hydrochloric acid was found to have the following percentage composition: Silica 89.52, ferric oxid 1.92, manganic oxid 0.15, alumina oxid 0.01, calcium oxid 2.65, magnesium oxid 0.08, potassium oxid 4.73, and sodium oxid 1.34.

"The question is whether this matter insoluble in strong hydrochloric acid, is formed in the animal body or in the plant or, perhaps, in the process of incineration. It is presumed, of course, that no insoluble mineral matter can enter the plant as such through the roots."

The loss of nitrogen in the drying of urine, P. SCHWEITZER (*Missouri Sta. Rpt. 1898, pp. 95-100*).—In connection with digestion experiments with steers, a number of experiments were made to determine the cause of the observed loss of nitrogen in drying urine. The nitrogen in the urine was determined in several different ways. Tests were also made to learn whether an aqueous solution of urea with and without sodium phosphate lost weight when absorbed in sand and dried. The results of the tests, however, were not regular, and definite conclusions were not drawn.

"The decomposition of urea seems to occur more readily in a dilute solution than when concentrated, and more is decomposed in the presence of sodium phosphate than in aqueous solution. The mucous and coloring matters in urine are, however, also instrumental by their own alteration to act upon the urea present so that the writer is unable to suggest any method of drying urine which would yield, without loss of nitrogen, the whole of the solids of a certain volume.

"This, of course, must be taken into account when making calorimetric determinations with the dried materials."

The loss of nitrogen in the drying of feces, P. SCHWEITZER (*Missouri Sta. Rpt. 1898, pp. 87-95*).—A number of experiments were made to determine the character and amount of loss of nitrogen of the feces of steers fed timothy hay. When the feces were sterilized in closed bottles and kept some time, there was no loss of nitrogen. Samples were dried in air at 70° C., and afterwards in an oil bath or oven at 101° C.; in an oven at 101°, and over sulphuric acid. Samples of fresh feces were treated with water and distilled. A number of determinations were made of the nitrogen in the fresh material and in samples completely dried in the usual laboratory methods. The results of the test follow:

"The excrements of cattle on being voided have an alkaline reaction, owing to the presence therein of ammonia; they likewise contain skatol and sudol. This causes loss in nitrogen by drying, whether done by heat or water absorbing substances, which seems proportional to the intensity of heat, the length of time and the completeness of the drying.

Under the conditions prevailing in our digestion experiments, where drying was effected at a temperature not exceeding 70° C., and the dried material retained from 8 to 7 per cent of moisture, the loss in nitrogen calculated for water-free excrements amounted on an average to 0.08 per cent. It is possible by proper management to effectively sterilize and preserve fresh excrements so that no nitrogen is lost and, perhaps also, the water contents are not altered."

Proximate composition and calculated thermal value of feeds and feces, P. SCHWEITZER (*Missouri Sta. Rpt. 1898, pp. 102–105*).—The author compares the determined heat of combustion of a number of feeding stuffs and of the feces of 3 steers with similar values calculated on the basis of the thermal value of the proximate constituents of the materials. The calculated heat of combustion of feces was from 6.82 to 8.42 per cent lower than the value as determined. The calculated heat of combustion of the feeding stuff was 3.49 per cent lower. The results are discussed at some length.

"The four proximate principles, commonly determined in a so-called feed-stuff analysis, each consist of groups of bodies which, while having something in common, yet differ from one another in composition, digestibility, and properties in general. I hold this to be true even in the case of crude fiber, where, perhaps, a reasonable doubt might be entertained of its composite character."

The determination of fiber in feeding stuffs, P. SCHWEITZER (*Missouri Sta. Rpt. 1898, pp. 105–111*).—A comparison of the official method with Müller's bromin and ammonia method, using excelsior, cornstalks, and corn leaves. The constituents of the crude cellulose obtained from the 3 materials with the 2 methods are described and the amounts estimated. The constituents other than fiber were also determined, and the results are summarized as follows, the crude fiber being determined in Nos. 1, 3, and 5 by the official method and in Nos. 2, 4, and 6 by the bromin and ammonia method:

Analysis of excelsior, cornstalks, and corn leaves.

	Excelsior.		Cornstalks.		Corn leaves.	
	1.	2	3.	4.	5.	6.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Ether extract	1.08	0.98	1.79	1.80	1.87	1.70
Alcohol extract	3.71	3.75	27.45	27.17	16.91	16.88
Crude ash	.84	.84	3.72	3.71	10.36	10.37
Protein	1.26	1.26	8.53	8.50	14.90	14.93
Fiber	46.73	46.26	29.52	29.34	23.94	23.21
"Vasculose"	16.11	(16.11)	.69	(.69)	.38	(.38)
"Pectose"	(17 60)	17.60	(11.36)	11.36	(15.75)	15.75
Carbohydrates	12.67	13.20	16.94	17.43	15.89	16.78
	100.00	100.00	100.00	100.00	100.00	100.00

The effect of heating the samples under pressure in a Papin digester for from 1 to 6 hours was tried, and the resulting fiber was examined. The conclusion was reached that "the digester method is evidently not adapted to increase our knowledge of the fibers in feeding stuffs."

Lactic acid determination by means of alcohol, G. WALCK (*Pharm. Ztg., 44 (1899), pp. 906, 907; abs. in Chem. Centbl., 1900, I, No. 4, p. 267*).—Soxhlet has shown that previous to the beginning of lactic acid production in fresh milk a certain time intervenes in which the lactic acid germs increase without any increase in the acidity of the milk. This period, which depends upon the temperature and the condition of the milk, Soxhlet has called the incubation period, and he holds that milk should not be used beyond this period.

To determine the exact degree of acidity milk is titrated, using phenolphthalein as indicator, but in some north German creameries this is determined approximately by the behavior of the milk on the addition of 68 per cent alcohol. The author studied the relation between degree of acidity and the curdling with alcohol, and found that the amount of 68 per cent alcohol required to curdle milk diminished as the degree of acidity increased. Milk which did not curdle when mixed with an equal volume of alcohol was found to have a small degree of acidity, did not curdle by cooking, required at most 2 cc. of decinormal alkali to neutralize 10 cc. of milk, and was suitable for children. Milk which under similar conditions gives flocculent curdling is said to be past the incubation period and no longer suitable for children. Milk which curdles on the addition of a small amount of alcohol is sour, will curdle when cooked, and is unfit for consumption.

This simple method the author believes to be useful for the rapid and simple determination of the approximate acidity of market milk.

Proceedings of the sixteenth annual convention of the Association of Official Agricultural Chemists, held at San Francisco, Cal., July 5, 6, and 7, 1899 (*U. S. Dept. Agr., Division of Chemistry Bul. 57, pp. 130*).—This is a detailed account edited by the secretary of the association, H. W. Wiley. For a summary of the proceedings see E. S. R., 11, p. 204.

Bibliography for the use of the Swiss Government analytical laboratories and similar institutions (*Litteratur-Verzeichniss fur die Schweizerischen kantonalen Laboratorien und ahnliche Untersuchungsanstalten. Basel: Wakernagel; rev. in Ztschr. Untersuch. Nahr. u. Genussmtl., 3 (1900), No. 4, p. 299*).—This compilation was made for the Society of Swiss Analytical Chemists at their yearly meeting in Lugano in 1899.

Investigations on caramel bodies, F. STOLLE (*Ztschr. Ver. Deut. Zuckerind., 1899, Nos 524, II, pp 800–807; 525, II, pp. 839–842*).

The determination of phosphorus in organic compounds, C. MARIE (*Bul. Soc. Chim. Paris, 3. ser., 23 (1900), No. 1, pp. 44, 45*).

On the volumetric determination of boric acid, A. STOCK (*Compt. Rend. Acad. Sci. Paris, 130 (1900), No. 8, pp. 516, 517*)

Tests for cotton-seed oil and sesame oil in fats, J. LYNE (*Ind. Lait., 25 (1900), No. 15, pp. 114, 115*).—Methods of detecting these oils in butter, including the reactions of Becchi, Baudouin, and Halphen, are briefly discussed.

Volumetric determination of the dirt in milk, A. SCHLICHT (*Ber. Chem. Hyg. Untersuchungsamtes. Stadt Stralsund, 1894–1899, p. 21, fig. 1; abs. in Ztschr. Untersuch. Nahr u. Genussmtl., 3 (1900), No. 5, p. 343*).—The milk is whirled in a centrifuge in a tube drawn out at the bottom into a narrow graduated neck.

Handbook of practical hygiene, D. H. BERGEY (*Easton, Penn.: Chemical Pub. Co., pp. 164*).—"A short and concise laboratory guide for the sanitary analysis of air, water, soil, and the principal food materials; also a chapter on the ventilation of buildings."

Estimation of the acidity of milk by means of alcohol, G. WALCK (*Pharm. Ztg., 44 (1899), pp. 906, 907; abs. in Ztschr. Untersuch. Nahr. u. Genussmtl., 3 (1900), No. 5, p. 343*).

Human milk, I. CALLARI (*Gaz. Osp. e Clin., 21 (1900), No. 24, pp. 248–250*).—Analyses are reported.

Detection of artificial organic coloring matters by means of spectral analysis, J. FORMÁNEK (*Spektralanalytischer Nachweis kunstlicher organischer Farbstoffe. Berlin: J. Springer, 1900, pp 10+196, ill.; rev. in Ztschr. Untersuch. Nahr. u. Genussmtl., 3 (1900), No. 5, pp. 375, 376*).

Analyses of resins, balsams, and gums; their chemistry and pharmacology, K. DIETERICH (*Analyse der Hartze, Balsame und Gummiharze nebst ihrer Chemie und Pharmakognosie. Berlin: J. Springer, 1900, pp. XVI+286*).—A text-book designed for use in scientific and technical laboratories.

Ash analyses of some common plants, P. SCHWEITZER (*Missouri Sta. Rpt. 1898, p. 83*).—Tabulated analyses are given of purslane (*Portulaca oleracea*), plantain (*Plantago major*), Kentucky coffee beans, and thorns of honey locust.

BOTANY.

The physiological rôle of mineral nutrients, O. LOEW (*U. S. Dept. Agr., Division of Vegetable Physiology and Pathology Bul. 18, pp. 60*).—In this bulletin is presented what has been accomplished by the author and others in determining the physiological rôle of mineral nutrients in the plant and animal body. After a historical statement of the subject, general remarks on the mineral constituents found in organisms, and the general value of mineral salts considered from an ecological standpoint, the author takes up their physiological rôle. As physiological elements, he considers potassium, sodium, calcium, magnesium, iron, phosphorus, chlorin, iodin, carbon, hydrogen, nitrogen, oxygen, and sulphur. Of these, magnesium and potassium salts and phosphoric acid are held to be essential to every living cell. Sodium salts are not essential for the physiological uses of plants, but are for those of animals. Calcium salts are necessary to all higher plants and animals.

In the present bulletin the author considers the physiological rôle of phosphoric acid, iron compounds, halogen compounds, alkali salts, and calcium and magnesium salts. Phosphoric acid is said to be essential to the production of lecithin and chromatin and plastin, the most essential constituents of the nucleus and plastids. Cell division can only take place in the presence of an abundant supply of phosphoric acid. The chief function of lecithin is said to be in respiration, the fat being presented to the protoplasm in the form of lecithin. Phosphoric acid is also necessary for chlorophyll production, and potassium phosphate is an important cell constituent.

The relation between chlorophyll and hæmoglobin in the blood is pointed out, and the necessity of iron to both is shown. Among the fungi, iron is not essential, and although manganese is often present in the ash of some of the higher plants to a greater extent than iron, it can not replace it in its physiological action.

The action of the chlorids of potassium and soda is stated, the other compounds with chlorin being considered injurious. While beneficial to some plants in certain stages of growth, an excess of the limited amounts of the potassium and sodium chlorids required proved highly injurious.

Among the alkali salts, potassium is shown to be important for the formation of starch and protein. Sodium salts can be disposed of by many plants, and it is thought that compounds of soda exert a favorable action in the ripening process of cereals. Sodium, it is claimed, can not replace potassium in the preparation of organic substances in plants.

The physiological rôle of calcium and magnesium salts is discussed at considerable length. Among other things, the author states that "magnesium salts are poisonous in the absence of calcium salts, while the absence of magnesium salts in an otherwise complete culture solution will lead to a gradual stoppage of development. The formation of the nuclei and plastids requires calcium as well as magnesium salts, the former for the production of calcium nucleo-proteids and the latter for making possible the assimilation of phosphoric acid."

On the absorption of soluble salts by plants, E. DEMOUSSY (*Ann. Agron., 25 (1899), Nos. 11, pp. 497–548; 12, pp. 561–607, dgms. 4*).—The author conducted a series of experiments with peas, maize, colza, buckwheat, crimson clover, rye grass, wheat, and rye, to test their capacity to absorb through their roots the nitrates of potassium, calcium, sodium, magnesium, strontium, and barium, chlorids of potassium and sodium, and the bromids and iodids of potassium; also to ascertain the selective capacity of plants in separating a given substance from a mixed solution.

Seeds were germinated in distilled water and the plantlets transferred to vessels containing known quantities of the salt under investigation. It was found that the abundance of nitrates in a plant depends upon the readiness with which they are separated from dilute solutions. Once within the plant, they are protected from the solvent action of the medium as long as the plant is alive, but are quickly diffused after the death of the plant.

Provided the base with which the nitric acid is in combination is not poisonous, there is no difference in the absorption of the different salts. When presented alone, sodium nitrate is taken up as readily as potassium nitrate, and the nitrates of calcium and magnesium as well as those of sodium and potassium. The nitrates of lithium, strontium, and barium are absorbed very slowly and their noxious effect is soon shown. The chlorids act in a similar manner to nitrates. Their rôle in the plant's economy is thought to be greatly inferior to that of the nitrates.

Investigations on the selective power of plants show that when the cultures contain nitrates and chlorids of the same base, more of the nitrate is taken up by the plant. More potassium is taken than sodium and in the presence of potassium sodium is not absorbed. Calcium is not able to prevent the absorption of sodium.

Some physiological effects of hydrocyanic-acid gas upon plants, W. G. JOHNSON (*Sci. Amer. Sup., 48 (1899), No. 1249, pp. 20026, 20027, figs. 6*).—This is a revision of a paper read by the author before the American Association for the Advancement of Science, August, 1899.

The history of the use of hydrocyanic-acid gas as an insecticide is briefly reviewed and a number of experiments outlined, in which the effect of the gas on the foliage and vitality of a number of varieties of trees are reported. A number of thoroughly dormant trees were subjected for 30 minutes to gas generated by different amounts of potassium cyanid. No injury was noted on any of the trees.

In 1897 another series of experiments was conducted, in which trees in full foliage were fumigated at all hours of the day and in all conditions of weather. Within 5 minutes after the tents were removed, the petioles of the leaves were black to the base and the leaves fell a few days later. The following spring the leaves came out as normally and there was about one-fourth as much fruit upon the trees as on those which had been fumigated with a normal strength of the cyanid. Trees fumigated at night with double the quantity were comparatively little injured. The fruit buds, however, were destroyed to some extent.

These experiments seem to indicate that the gas was most injurious to foliage during sunshiny days, late in the fall, between 9 a. m. and 4 p. m.; that dormant leaves in fruit trees treated with 0.2 gm. per cubic foot were uninjured; that burned leaves fall readily, and that treatment in the morning before 9 o'clock and in the afternoon after 4 o'clock, even in sunshine, affected the leaves but little, while trees treated at night with normal doses are not injured at all.

Other experiments are outlined, and in conclusion the author states that "we can say that the danger point where well-matured nursery stock is injured by hydrocyanic-acid gas is so far above the standard used that practically no damage can result from an overdose. With apple and pear there is practically no injury even with the strongest applications. Plum is slightly more susceptible, being injured at 0.65 gm. per cubic foot. In the peach the injury began at 0.5 gm. in well-matured trees, but it is fatal in low-grade trees at above 0.18 gm."

Photosynthesis by light which has passed through leaves, E. GRIFFON (*Compt. Rend. Acad. Sci. Paris, 129 (1899), No. 26, pp. 1276-1278*).—The results of a number of experiments in which light made to pass through leaves exerted upon the photosynthesis of other leaves are reported. In the case of sycamore, maple, chestnut, beech, and mulberry, the leaves having approximately the same thickness, there was considerable carbon assimilation when one leaf was superimposed upon another, and the same was true, but to a less extent, when large thick leaves, such as barberry, *Prunus cerasus*, etc., were used. However, when two or more leaves were superimposed under the same condition, there was generally a slight liberation of carbon dioxid. The passage of the light through a single leaf still contained sufficient force to serve for the photosynthesis of the leaves which were shaded. The light traversing the leaves has its photosynthetic power reduced not only on account of the absorption of the chlorophyll through which it passes, but also by absorption through any uncolored portions of the leaves, the tissue of the leaf, and the protoplasm.

If a leaf blanched with alcohol be placed over another, the energy of assimilation is reduced from 2 to 2½ times, and a natural albinal leaf reduces it two or more times. A green tobacco leaf placed over another reduces the photosynthesis of the under leaf 5 times as much as an albinal leaf of the same plant.

From these investigations it is apparent that the principal cause of the reduction of assimilative power of leaves shaded by other leaves is due to the absorption by the chlorophyll.

Photosynthesis and the coloration of plants, E. Griffon (*Ann. Sci. Nat. Bot., 8. ser., 10 (1899), No. 1-2, pp. 1-123, pls. 4*).—In an extended series of observations the author has sought to ascertain the relation between the assimilative energy of plants and their color. The experiments are grouped into classes as follows: Phanerogams with dark green foliage and those having other colored leaves than green, parasites and saprophytes; and the action of color in connection with light, heat, and various salts. The specimens under examination were placed in a form of apparatus containing air of known composition, and after the usual exposure analysis showed what change had taken place. In this way a proportion was established between the different plants under the varying conditions.

The coloration of the leaves of phanerogams was found to vary widely. The intensity of the green of the chlorophyll is said to depend upon the thickness and differentiation of the mesophyll and upon the number, size, color, and distribution of the chromoleucites. All these factors have an important bearing upon photosynthesis. In some plants the green may be masked by anthocyan and erythrophyll, or the chlorophyll may be wholly wanting as in variegation. It was found that in nearly related species and varieties of plants differences in the intensity of coloration were apparent. In the case of cereals, lettuce, begonias, and fuchsias, those having deep green leaves possessed a greater assimilative energy than the light green ones. In the case of peaches, plums, cannas, and chrysanthemums the pale green leaves assimilated most actively. Among the plants having various colored foliage it was found that red beets, purple filberts, *Prunus pissardi*, purple sycamore, cannas, arums, and pelargoniums assimilated less than varieties of the same plants having dark green leaves. In the case of red atriplex and beech, which have the coloring matter in their epidermis, and the purple barberry, whose coloring matter is in the palisade, their assimilative energy equaled that of species of the same plants which were rich in chlorophyll. In leaves which redden and fall in the autumn the liberation of carbon dioxid is said to take place for some time after the appearance of the red coloration. There is some little assimilation, but it is masked by the respiration. The chloroleucites after awhile are completely disorganized. The anthocyan appears in all the cells and the leaves take on the red coloration. They continue to respire for a time, but soon perish. Grape leaves which do not normally take on a red coloration sometimes behave during August and September in a manner analogous to that just described. This affection, which is known as "rougeot," is in reality an autumnal reddening brought about accidentally and prematurely by unusual meteorological conditions.

The investigations of the parasites and saprophytes showed that the terrestrial orchids occupy an intermediate position, so far as photosynthesis is concerned, between the green leaved plants and those which live wholly as saprophytes. *Limodorum abortivum*, a plant which possesses highly colored foliage, although containing a considerable quantity of chlorophyll, seems to be without the ability to utilize the carbon dioxid of the air.

Among those plants which are able to form chlorophyll in darkness, the piñon pine decomposes carbon dioxid when brought into the light. Whether the chlorophyll in this case differs from that produced in the light is not determined. Intensity of green coloration and structure were found to vary with the refrangibility of the rays to a considerable extent. Heat, within certain limits, increases the thickness and differentiation of the mesophyll of leaves and the dimension and color of the chloroleucites, and as a result increases the photosynthetic ability of the plant.

The author states that it has long been known that nitrates and the salts of iron favor the production of chlorophyll and as a result increase the assimilative energy of the plants. Copper salts when added to nutrient solutions in very small quantity, as 1 to 10,000 or 1 to 20,000, while attacking the roots and retarding growth, increase the color of the chloroleucites and also the intensity of the color of the plant, assisting materially in the assimilative energy. Sodium chlorid is unfavorable to the formation of chlorophyll, and gives to plants a greenish yellow or pale green color, which is quite characteristic. At the same time the mesophyll of the leaf is thickened, but the structure is not favorable to an increased utilization of carbon dioxid. An excess of lime, among other causes, results in chlorosis of a number of plants. These plants take on a yellowish color and the photosynthesis is reduced to one fifth or one-sixth that of normal leaves in case of the pear and grape.

The presence of copper in plants and the quantity they may contain, E. HECKEL (*Bul. Soc. Bot. France, 46 (1899), No. 1–2, pp. 42, 43*).—It is stated that *Polycarpœa spirostylis* so frequently contains copper that in Australia its growth is considered an indication of the presence of copper. Analyses of the above plant are quoted where 30 mg. of copper per kilogram of dry weight were found, and a second content of 560 mg. per kilogram dry weight where plants grew in soil very rich in copper.

The author states that the seeds of *Quassia gabonensis* were observed to contain considerable quantities of copper, and upon analysis 100 gm.

of the ash of the entire seed gave 0.698 gm. of copper, and the ash without the seed coat gave 0.254 gm., showing that the greater portion was in the seed coat.

In a similar way *Viola calaminaria* is said to contain considerable quantities of zinc, and the presence of the plant usually indicates zinc in the soil.

The root tubercles of plants, L. HILTNER (*Selsk. Khoz. i Lyesov., 192 (1899), Feb., pp. 425–462*).—After summarizing the previous investigations relative to the assimilation of free atmospheric nitrogen by the organisms in the root tubercles of leguminous and other plants, the author states his views as to the processes which take place within the tubercle. It is claimed that assimilation of nitrogen can take place only after the development of the organism and establishment of reciprocal relations between it and the host plant. The ability to transform free nitrogen into a form assimilable by the plant is not confined to a single genus of bacteria or fungi. In the tubercles of legumes are found true bacteria, in eleagnus are organisms intermediate between bacteria and fungi. in the Cyperaceæ are found entorrhiza, and endotropic mycorrhiza in the tubercles of Podocarpus, and, according to some investigators, physiologically similar organisms are found in sago.

The author concludes that all the organisms in question appear as true parasites and are to a greater or lesser degree injurious to the host plants. The parasitic action of the tubercle organisms is shown by the secretion of certain peculiar substances. If a tubercle from an alder tree be triturated in sterilized water and filtered through a Chamberland filter and young alder plants inoculated with the filtrate, the root hairs of the alder begin to shrivel and deformities similar to those which take place on infection with the bacteria are produced, although no tubercles are found. It is as yet unknown whether these secretions aid in inducing the assimilation of free nitrogen.

The injurious influence of the secretory products disappears when the tubercles attain their final development, but since these products continue to form inside the mature tubercle the supposition is that they are immediately converted into substances harmless to the plant. Such a conversion takes place with the cooperation of the host plant by supplying the organism with a part of the nutritive substances produced by the plant. This is further corroborated by the fact that from legumes and alders bacteria can be grown only in nutrient media containing extracts from the roots of leguminous or alder plants. The exclusive preference which is shown by *Bacillus radicicola* to leguminous plants tends to prove that Leguminoseæ alone are capable of producing the substances necessary for bacteria, the nature of which is being investigated. Starch apparently serves only in part as a nutrient material for tubercle organisms, as is seen in the active tubercle containing more starch than can be immediately consumed.

The host plant not only tends to render harmless the metabolic processes of the parasite, but it offers direct resistance to the parasite. In leguminous plants, as well as in the alders, mucous threads are found soon after the infection inside many roots of the hairs. However, tubercles are not always found where mucous threads have appeared. The number of tubercles is comparatively small. In the case at least of the alder the tubercles are formed only when the mucous threads penetrate the root cells and reach the nuclei. Having attained this, they are no longer liable to absorption by the host plant. In tubercles in the process of formation the bacteria endeavor to protect themselves against the host plant by forming bacteroids and sporangia which present an increased surface for the absorption of gases. Owing to such an adaptation, they are enabled to construct from the atmospheric nitrogen albuminous compounds which are gradually taken up by the plant. By microchemical tests substances resembling albumin can be observed both inside and around the bacteroids in tubercles of legumes, alders, and eleagnus. These substances, which are of a faint green color, are soluble in water in the case of the legumes, but insoluble in case of the others, and are transported through the usual channels to the aerial portions of the plant.

Legumes and alders with active tubercles are resistant to a second infection by tubercle organisms, but they are not immune when the tubercles are inactive.

Toward the fall of the year, when the supply of carbohydrates on the part of the plant ceases, the process of assimilation of atmospheric nitrogen stops. The tubercle organisms are not all absorbed by the plant owing to its weakness at that time. In the remaining tubercles the nitrogen content falls to a minimum.

In conclusion the author claims that the relation between the tubercle organisms and their host plants is that of two contending parties. The bacteria draw on the nitrogen of the air in their endeavor to make up the deficiency of nitrogenous substances which are taken from them by the plant.—P. FIREMAN.

Lessons in botany, G. F. ATKINSON (*New York: Henry Holt & Co., 1900, pp. XV+365*).—This book is an abbreviated and simplified edition of a previous work by the author (E. S. R., 10, p. 611), and is designed for the use of pupils in secondary schools where short or half-year courses in botany are given.

The first chapter is devoted to a study of seedlings, and this is followed by chapters on shoots, buds, and protoplasm, after which the same order as that observed in the larger book is followed, the technical matter being to a great degree simplified.

Minnesota plant life, C. MACMILLAN (*Minnesota Bot. Studies, 3. ser., 1899, pp. 568, pls. 4, figs. 240*).—In this work the author seeks to give the reader in popular though exact language an idea of the diversified plant life of the State. The different groups of plants are reviewed in their natural order, some of the plant structures and behaviors described, and some ecological problems explained, the hope on the part of the author being to inspire a desire for a broader knowledge, a deeper interest, and a truer appreciation of plant life.

New or little known Mexican grasses, F. LAMSON-SCRIBNER (*U. S. Dept. Agr., Division of Agrostology Cir. 19, pp. 4, fig. 1*).—The author describes a number of species of grasses which are new to science and gives notes on a number of others, all of which were collected by C. G. Pringle during the season of 1899. The new species and varieties described are: *Panicum pilosum macranthum*, *P viscidellum*, *P. multirameum*, *P. albomaculatum*, *Avena micrantha*, and *A. stipoides*.

Native and introduced grasses found at Stillwater., Okla., J. H. BONE (*Oklahoma Sta. Rpt. 1899, p. 87*).—A list of some 45 species of grasses is given, together with the common and scientific names, period of growth, and date of blooming.

Native food plants, J. H. MAIDEN (*Dept. Agr. New South Wales, Misc. Pub. 282, pp 65*).—A botanical description is given of a large number of Australian native food plants.

Inventory of foreign seeds and plants, O. F. COOK (*U. S. Dept. Agr., Division of Botany, Inventory 5, pp. 62*).—A list of species and varieties of plants recently introduced through the Section of Seed and Plant Introduction of this Department. Most of this material was collected in France, Italy, and Algeria by W. T. Swingle. In addition to this list, miscellaneous collections from a number of sources are mentioned.

Inventory of foreign seeds and plants, O. F. COOK (*U. S. Dept. Agr., Division of Botany, Inventory 6, pp. 15*).—This circular contains an inventory of foreign seeds and plants collected by B. Lathrop and D. G. Fairchild in Austria, Italy, and Egypt.

A revision of the western North American phloxes, E. NELSON (*Wyoming Sta. Rpt. 1899, pp. 1-36*).—This revision contains a summary of our knowledge of western species of phlox, together with descriptions of a number of new species and varieties. It was presented by the author as a thesis for a degree in the University of Wyoming.

A preliminary ecological study of the native and introduced plants of the vicinity of Columbia, Mo., F. P. DANIELS (*Missouri Sta. Rpt 1898, pp. 124-156*).—A study was made of plants in their native localities with special reference to their culture, conditions of soil, and climate and other environmental conditions A list of the flora of the regions is given, arranged according to the ecological distribution of the plants.

Culture experiments on the adaptation of plants to climate, G. BONNIER (*Compt. Rend. Acad. Sci. Paris, 129 (1889), No. 26, pp. 1207-1213*).—Notes are given on a number of investigations made under the author's direction, in which the effect of Mediterranean climate on a large number of plants is shown. The differences between the cultivated plants and those in the original conditions are pointed out. The author thinks that it is possible that a great number of plants may be able to change their form in order to adapt themselves to Mediterranean conditions.

Plasmolytic studies on the growth of cell membranes, O. REINHARDT (*Festschr. Schwendener, Berlin, 1899, pp. 41*).

On the cytological phenomena preceding and accompanying the formation of the teleutospores of Puccinia liliacearum, R. MAIRE (*Compt. Rend. Acad. Sci. Paris, 129 (1899), No. 21, pp. 839-841*).—Notes are given on the various cytological changes which are observed in this fungus which is parasitic on the leaves of *Ornithogalum pyrenaicum*.

The fixation of carbon by leaves, H. T. BROWN (*Nature, 60 (1899), No. 1559, pp. 474-483, dgms. 3*).—Presidential address before Section C of the British Association for the Advancement of Science. Photosynthesis is described and some experiments on the rate of carbon dioxid assimilation are briefly outlined. A brief review of this address is given in *Jour. Hort., 51 (1899), No. 2661, p. 271.*

Protein synthesis in phanerogams, B. HAUSTEEN (*Jahrb. Wiss. Bot., 33 (1899), No. 3, pp. 417-486, figs. 2*).

The physiological significance of alcohol in the vegetable kingdom, P. MAZÉ (*Compt. Rend. Acad. Sci. Paris, 128 (1899), No. 26, pp. 1608-1610*).

On the presence of formaldehyde in plants, G. POLLACCI (*Bol. Chim. Farm., 38 (1899), p. 601; abs. in Chem. Ztg., 23 (1899), No. 36, Repert., p. 352*).—A number of experiments are briefly outlined from which the author concludes that formaldehyde is formed in green leaves in the sunlight.

Effect of arsenic on plants, R. Bouilhac (*Bul. Soc. Bot. France, 46 (1899), p. 64*).—A number of fresh water algæ are said to absorb arsenic acid from arsenates without apparent injury, while the growth of one (*Schizothrix lardacea*) appears more favorably influenced by arsenic acid than by phosphoric acid.

Influence of electricity on plants, H. Euler (*Ofver. K. Svensk. Vetensk. Akad. Förhandl., 1899, No. 56, pp. 609–629*).

The effects of the fog at Chiswick (*Gard. Chron., 3. ser., 26 (1899), No. 672, p. 356*).—Notes are given of the effect of prolonged fog on plants. The leaves became very tender and later appeared as though badly scorched. The worst injury appears to have been done to plants grown under glass.

The assimilation of atmospheric nitrogen by the mycelium of aerial parts of plants, L. Hiltner (*Centbl. Bakt. u. Par., 2. Abt., 5 (1899), No. 24, pp. 831–837*).—On account of the reputed symbiotism between darnel and the fungus infesting it, cultures were made of the plant, comparisons being made with *Lolium italicum*, which is supposedly free from the fungus. There was apparently some gain of nitrogen in the darnel, but the author does not feel warranted in drawing conclusions from the experiment. The investigation is to be continued, when it is hoped to obtain well-developed seed, the fungus mycelium being much more abundantly developed in the seed than elsewhere.

Alinit: A bacteria of the soil (*Florists' Exchange, 11 (1899), No. 44, p. 1104*).

Is the Alinit bacterium a single species? R. Hartleb (*Centbl. Bakt. u. Par., 2. Abt., 5 (1899), No. 21, pp. 706–712*).—Studies were made of *Bacillus ellenbachensis*, *B. megatherium*, and *B. subtilis*, and the author claims they are specifically distinct.

The assimilation of atmospheric nitrogen by Alinit bacteria, J. Stoklasa (*Centbl. Bakt. u. Par., 2. Abt., 5 (1899), No. 10, pp. 350–354; 6 (1900), No. 1, pp. 22–24*).—The author reviews a number of experiments with wheat, in which it is claimed there was a marked gain due to Alinit inoculation.

Results of experiments with Alinit, O. Lehmann (*Deut. Landw. Presse, 26 (1899), No. 82, p. 938*).

Investigations of Alinit, W. Krüger and W. Schneidewind (*Landw. Jahrb., 28 (1899), No. 3–4, pp. 579–591*).—A report is given of experiments in the laboratory and pots with Alinit to determine its ability as an assimilator of atmospheric nitrogen. In the culture experiments beets, potatoes, oats, mustard, and rye were grown and comparisons made with and without Alinit and applications of nitrate of soda. In every case the application of the Chile saltpeter gave the greatest yields, and only with beets did the Alinit give any increase over the noninoculated lots. The conclusion of the authors is that in practice Alinit is without value.

On the hybrid fecundation of albumin, H. Devries (*Compt. Rend. Acad. Sci. Paris, 129 (1899), No. 23, pp. 793–795*).—Notes are given by the author on a number of investigations on the immediate effect of cross fertilization on the development of endosperm of seeds. The examples cited are mostly from experiments conducted with sweet and starchy varieties of maize. Numerous cross-fertilization experiments were made with the result as shown by the seed that immediate effect of the pollen was very marked.

Investigations on Xenia of maize, C. Correns (*Ber. Deut. Bot. Gesell., 17 (1899), No. 10, pp. 410–417*).—A preliminary note is given of the author's investigations on the influence of pollen upon the endosperm as shown in the crossing of races and varieties of maize. A number of fundamental principles are laid down as to the prepotency of one or the other parents.

Some thoughts on hybridizing, W. A. Christy (*Amer. Florist, 15 (1900), No. 617, pp. 1044–1046*).—Popular suggestive notes on this subject.

Concerning the use of some well-known coloring reagents in microscopic investigations, M. Claudius (*Centbl. Bakt. u. Par., 2. Abt., 5 (1899), No. 16–17, pp. 579–581*).

METEOROLOGY.

Meteorological report, C. B. RIDGAWAY (*Wyoming Sta. Rpt. 1899, Met. Rpt. 1898, p. 24*).—A brief statement of the equipment of the station for meteorological observations, with tables giving daily observations on temperature, terrestrial radiation, relative humidity and dewpoint, atmospheric pressure, and wind movement at Laramie, Wyo., for each month of 1898, as well as weekly means of soil temperatures and a monthly summary of precipitation and evaporation for 1891–1898. The summary for 1898 is as follows:

Temperature (degrees F.).—Highest, 88, June 30 and July 26; lowest, —23, January 26; mean for the year, 38.3; highest daily range, 57, June 29; lowest daily range, 3, February 22; mean daily range for the year, 26.4. *Humidity.*—Mean relative for the year, 57.6; lowest relative, 13, July 26 and September 19. *Dew-point.*—Highest, 58°, July 10; lowest, — 21°, December 9; mean for the year, 23.8°. *Terrestrial radiation.*—Highest, 12°, June 11; mean for the year, 3.9°. *Atmospheric pressure* (inches).—Highest, 23.408; lowest, 22.47; mean for the year, 23.020. *Precipitation* (inches).—Highest monthly, 1.88 in June; lowest monthly, traces in September; highest during any single storm, 0.55, August 4; mean for 8 years, 9.95. *Evaporation.*—Total for 6 months (April 15 to October 15), 41.4 in.; greatest monthly, 10.33 in. in June. *Wind.*—Prevailing direction, southwest; greatest velocity, 60 miles per hour; total number of miles traveled during the year (351 days), 99,571; greatest number of miles traveled in 1 month, 11,118, in March; lowest number of miles traveled in 1 month, 4,854, in August; average number of miles for each month, 8,297.6; greatest number of miles in 1 day, 700, October 3; least number of miles in 1 day, 24, August 17; mean daily distance traveled, 283 7; mean hourly distance traveled, 11.8.

Climatic conditions of Oklahoma, J. FIELDS (*Oklahoma Sta. Rpt. 1899, pp. 41–45*).—The general climatic conditions of Oklahoma and their relation to the character of farming pursued are briefly discussed. It is stated that the amount and distribution of rainfall is the most important factor in determining the class of farming which may be profitably undertaken.

"As in the States north and south of Oklahoma, the rule is that the rainfall decreases from east to west and with increased elevation. The evidence is conclusive that eastern Oklahoma has sufficient rainfall so distributed throughout the year as to make the cultivation of most ordinary farm crops reasonably safe, except on high, sloping uplands. It is equally well settled that western Oklahoma is best adapted for grazing purposes; that the soil there had best be left in the natural grass crop, unless irrigation is practicable, or in case of some creek or river bottom land.

"There is a middle section, the boundary lines of which can not be exactly stated, the fitness or unfitness of which for farm crops can not be stated with equal positiveness."

Tables prepared by J. I. Widmeyer show the monthly and annual mean temperatures for 8 years, 1891–1898, at Oklahoma City, and for 4 years, 1895–1898, at Stillwater, Okla., and the total monthly and annual precipitation for periods ranging from 4 to 10 years at 10 places in the Territory.

Meteorological observations at Michigan Agricultural Experiment Station for the year 1897, R. C. KEDZIE (*Michigan Sta. Rpt. 1898, pp. 143–167*).—Tabulated daily and monthly summaries of observations during 1897 on temperature, pressure, precipitation, humidity, cloudiness, wind movement, etc.

The summary for the year is as follows: Mean temperature, 47.01° F.; humidity, 91 per cent; atmospheric pressure (reduced to 32° F.), 29.115 in.; cloudiness, 53 per cent; amount of rain or melted snow, 34.63 in.; snowfall, 39⅝ in.; number of thunderstorms, 16.

Weather report for 1899, G. T. L. (*Agr. Students' Gaz., n. ser., 9 (1900), No. 6, pp. 188, 189*).—A record is given of observations at the Royal Agricultural College, Cirencester, on temperature, rainfall, cloudiness, rainy days, and sunshine.

Observations made at the Blue Hill Meteorological Observatory, Massachusetts, U. S. A., in the years 1897 and 1898, A. L. ROTCH ET AL (*Ann. Astron. Observ. Harvard Col., 42, pt. 2, pp. 131–280*).—This contains the usual reports of meteorological observations made during 1897 and 1898, with an appendix by H. H. Clayton on measurements of cloud heights, velocities, and directions during the "cloud year" of 1896–97.

The weather, R. J. REDDING (*Georgia Sta. Bul. 46, pp. 55–57*).—A brief account of rainfall at Experiment, Ga , during the period from January to November, 1899, inclusive, and mean temperature and rainfall for the period from May to August, inclusive, for each year from 1890 to 1899.

Meteorological observations in the United Kingdom (*Jour. Roy. Agr. Soc. England, 3. ser., 11 (1900), pt. 1, pp. 183, 184*).—A tabular record is given of rainfall, temperature, and bright sunshine for England and Wales during 1899, with average and extreme values for previous years, and of the rainfall of 1899 and of the previous 10 years with the average annual fall for a long period as observed at 38 stations situated in various parts of the United Kingdom.

The campaign against hail in 1899, F. BLASIG (*Atti. Mem. I. R. Soc. Agr. Gorizia, 40 (1900), No. 1–2, pp. 39–51*).

An improvement of the telegraphic weather service, R. BÖRNSTEIN (*Mitt. Deut. Landw. Gesell., 15 (1900), No. 3, pp. 17, 18*).—Discusses the question of the dissemination of forecasts.

WATER—SOILS.

Soil investigations, H. SNYDER (*Minnesota Sta. Bul. 65, pp. 84, figs. 8*).—The work here reported is a continuation of previous investigations (E. S. R., 7, pp. 476, 477, 484) and deals with the chemical and mechanical composition of soils, the available plant food, the characteristic features of Minnesota soils, and the conservation of fertility.

The chemical composition of soils (pp. 1–39).—Analyses of 124 samples of soil (including surface soils and subsoils) from 64 different localities in Minnesota are reported, with descriptions of samples, explanations of terms, and interpretation of results.

The author's main conclusions regarding the 4 most important soil constituents as found in Minnesota soils are as follows:

"*Lime.*—Soils which contain from 0.3 to 0.5 per cent or more of lime and from 0.1 to 0.4 per cent of combined carbon dioxid, and are not strongly charged with alkaline salts, are reasonably well supplied with active lime compounds. . . .

"*Nitrogen.*—Prairie soils of average fertility show high percentages of nitrogen.

> Virgin soil from the Red River Valley has been found with 0.6 per cent of nitrogen. Soils of average fertility contain from 0.15 to 0.20 per cent. With less than 0.07 per cent there is usually a decided deficiency. The availability of the nitrogen depends largely upon the condition of the soil. If there is a good supply of available lime or other basic matter the conditions are favorable for nitrification, and a smaller percentage amount of nitrogen will suffice for crop growth. . . . Average soils with 0.15 per cent of nitrogen and with a good stock of available lime are not apt to be deficient in available nitrogen. . . .
>
> "*Potash.*—Soils that contain 0.4 per cent of potash and 0.4 to 0.5 per cent or more of lime as carbonate or sulphate are as a rule well supplied with available potash. . . .
>
> "*Phosphoric acid.*—A soil that gives an alkaline or neutral reaction and contains 0.15 per cent of phosphorus pentoxid, and is well supplied with organic matter and lime, is amply provided with phosphoric acid, and under such conditions the extensive use of phosphate fertilizers is not required except possibly for special crops."

The mechanical composition of soils (pp. 40–56).—Mechanical analyses of 28 typical Minnesota soils are reported, with descriptions of samples, interpretation of results, and a discussion, with illustrations, of the mineralogical character of the soil particles and the influence of lime, humus, and alkali on the texture of soils.

The available plant food of soils (pp. 57–67).—An account is given under this head of determinations of the sap acidity of a few agricultural plants; a comparison of the Dyer (extraction with 1 per cent citric acid) and Goss (extraction with $\frac{1}{5}$-normal hydrochloric acid) methods for determining available plant food in soils, and experiments in growing wheat in soils extracted with acids. The sap acidity (calculated as citric acid) was found to vary from 0.48 per cent in case of wheat to 1.02 per cent in clover.

The results by the Dyer and Goss methods on 3 soils were as follows:

Available phosphoric acid by Dyer and Goss methods.

	Soil A, very fertile	Soil B, of average fertility.	Soil C, old grain field.
	Per cent.	*Per cent.*	*Per cent.*
Total phosphoric acid	0 230	0.170	0.150
Available phosphoric acid, Dyer method	018	.021	.034
Available phosphoric acid, Goss method	061	.032	.018

The Goss method gave results which were more consistent and more in accord with the known fertility of the soil than Dyer's method.

A sample of soil of average fertility from the station farm (B, referred to above) was extracted with a 1 per cent solution of citric acid for 3 months, a small amount of nitrate of soda added, and wheat grown, normal vigorous plants being produced.

The extraction of the soil with citric acid had failed to remove all of the available phosphoric acid. An examination of the soil before and after extraction and the growth of the wheat gave the following results:

Composition of soil before and after extraction and growth of wheat.

	Original soil.	Soil after extraction and growth of wheat.
	Per cent.	*Per cent.*
Total phosphoric acid	0.17	0.14
Total nitrogen	.28	.20
Humus	8.94	3.81
Humic phosphoric acid	.04	.04
Phosphoric acid of humid acid precipitate	.03	.03
Potash (soluble in hydrochloric acid 1.115 sp. gr.)	.21	.15
Total insoluble matter	83.76	86.40

"The three months' treatment of the soil resulted in the removal of a larger proportional amount of the potash than of the phosphoric acid. Only a slight change in the percentage amounts of humus in the soil before and after the treatment is to be observed, while the phosphoric acid content of the humus and the humic acid precipitate remain unchanged. . . .

"The humic phosphates evidently have a material power to resist the action of acid solvents, but readily yield to alkaline solvents. . . .

"That the citric acid did not change some of the available phosphoric acid of the soil to active forms and that the source of the plant's phosphoric acid was that combined with the organic compounds was proven by direct experiment.

"Two kilograms of soil B was extracted with dilute hydrochloric acid and the humus obtained in the usual way. The humus was dissolved and treated as described in a former bulletin (E. S. R., 7, p. 477). From the kilogram of soil 60 gm. of purified humic material were obtained. The humus was mixed with acid-extracted sand, and a small amount of carbonate of lime and nitrate of soda. When wheat was seeded in this medium, normal plants were produced."

While extraction with $\frac{1}{5}$-normal hydrochloric acid was not directly tested, it is claimed that the results obtained in the experiments with the citric-acid-extracted soil indirectly prove that $\frac{1}{5}$-normal hydrochloric acid would not be effective in removing all of the available phosphoric acid. The author concludes that "both Dyer's and Goss's methods are, without doubt, applicable to certain types of soil, but not to those where a large part of the plant food is in organic forms."

The solubility of the potash of the 3 soils used in the above investigations in $\frac{1}{5}$-normal calcium chlorid, alkaline ammonium chlorid,[1] and 1 per cent citric acid was determined with the following results:

Solubility of soil potash in different solvents.

	Potash soluble in—		
	$\frac{1}{5}$-normal calcium chlorid.	Alkaline ammonium chlorid.	1 per cent citric acid.
	Per cent.	*Per cent.*	*Per cent.*
Soil A, very fertile	0.025	0.07	0.02
Soil B, of average fertility	.015	.02	.01
Soil C, old grain field	.021	.02	.01

---

[1] Prepared by dissolving 10.68 gm. of crystallized ammonium chlorid in 1 liter of $\frac{1}{20}$-normal ammonium hydroxid.

The results were not satisfactory. "Soils known to be deficient in available potash gave higher percentage amounts of soluble potash than soils known to be well supplied with this element."[1]

Characteristic features of Minnesota soils and conservation of fertility (pp. 68–84).—From analyses of 72 samples of surface soils and 52 samples of subsoils the following averages are obtained:

Average composition of Minnesota soils.

	Surface soil.	Subsoil.
	Per cent.	*Per cent.*
Insoluble matter	79.92	82.41
Potash	.43	.40
Soda	.45	.32
Lime	1.29	1.78
Magnesia	.61	.80
Iron and aluminia	7.20	8.32
Phosphoric acid	.20	.17
Sulphuric acid	.10	.06
Carbonic acid	.62	.93
Volatile matter[a]	8 98	5.33
Humus	3.66	....
Nitrogen	.20	.10

[a] The humus and nitrogen form a part of the volatile matter.

"A characteristic feature of nearly all of the soils of the State is a large amount of lime in the form of disintegrated limestone. Only a few soils have been found deficient in lime. . . . Not only is there a large amount of lime, but also a large amount of magnesia. . . . This large amount of basic matter takes an important part, both directly and indirectly, in imparting fertility. . . . The large amount of lime in the soils prevents the formation of acid soils and the plant food from becoming unavailable. . . .

"In the 72 surface soils only 2 were found to contain less than 0.15 per cent of potash and 6 less than 0.20 per cent, while 23 soils contained 0.50 per cent or more, the average amount being 0.43 per cent. The average soil of this State is well supplied with potash.

"In the soils examined about the same amount of soda as of potash was found. . . . In only 3 out of 72 soils was there less than 0.1 per cent of phosphoric acid. . . .

"A close relationship was observed between the amounts of nitrogen and humus of the soil, a high percentage of nitrogen being accompanied by a high percentage of humus. As a rule, there were from 10 to 12 parts of humus to 1 of nitrogen. . . . Many of the rich prairie soils contained originally 0.4 per cent or more of nitrogen—about a third of a pound of nitrogen in a cubic foot of soil. After 20 or 25 years of grain cultivation the nitrogen has been reduced to about 0.25 per cent.'

The influence of continuous grain cropping and summer fallowing on the nitrogen of soils is briefly discussed (see E. S. R., 9, pp. 632, 641). A discussion is also given of the reaction of soils, the amount of plant food in soils, the adaptability of soils to a variety of crops, weeds and fertility, reserve fertility of soils, and the importance of farm rotations and the use of farm manures.

---

[1] See also U. S. Dept. Agr., Division of Chemistry Bul. 56, pp. 53, 54.

"The soils tested have given acid, alkaline, and neutral reactions. Many of the soils that contain high percentages of humus and volatile matter gave slightly acid reactions as well as many that were reasonably well supplied with lime carbonate. . . . But few soils of this State gave decidedly acid reactions."

Analyses of waters, J. FIELDS (*Oklahoma Sta. Rpt. 1899, pp. 70, 71*).—A brief statement of some of the main conclusions from examinations of samples of potable and irrigation waters, the detailed results of which have been reported in bulletins of the station (E. S. R., 11, p. 223).

The problem of impoverished lands (*New York Cornell Sta. Bul. 174, pp. 89–122, figs. 2*).—This is a popular summary, compiled by L. H. Bailey, of information on this subject based on experiments and investigations at the station. The nature of soils, the principles of tillage and underdrainage, and the causes of impoverishment and the means of reclamation of soils are discussed. A series of questions and answers on the general subjects of soils and plant growth is given, with brief directions for making experiments with fertilizers.

Soil temperatures, C. B. RIDGAWAY (*Wyoming Sta. Rpt. 1899, Met. Rpt. 1898, p. 14*).—A table gives weekly means of observations during 1898 at depths of from 3 to 72 in. The means for the year were: 3 in., 42.3° F.; 6 in., 44.3°; 12 in., 44°; 24 in., 44.8°; 36 in., 45.3°; 72 in., 44.5°. The mean temperature of the air (see p. 1017) was 38.3°.

On the method of determining the heat evolved by soils when moistened, A. MITSCHERLICH (*Jour. Landw., 48 (1900), No. 1, pp. 71–80, figs. 2*).—This is a description and account of tests of a simplification and improvement of the method already described (E. S. R., 10, p. 423). It is claimed that by the new method the time required to make a determination is reduced from six to two hours and the errors become almost insignificant.

Productiveness of the soils of Ploti as related to climatic conditions, S. V. SHCHUSEV (*Plodorodie Plotyanskoi va sryazi sa Klimaticheskimi osobennostyami. Odessa, 1900, pp. 54 + III*).—This report is published by the experiment station of Prince Trubetskoi at Ploti. It is printed in Russian, with German title and résumé. In it an account is given of pot experiments with oats and barley grown on the same soil at 3 different places in Russia (Kiev, Ploti, and Novo-Alexandrovsk), and of a comparison of pot and field experiments. Incidentally Bogdanov's method of determining the fertility of soils (E. S. R., 11, p. 130) was studied. Wide variations in both the yield and quality of the crops grown at different places under different climatic conditions were observed.

Humus, A DE VILLÈLE (*Rev. Agr. Réunion, 5 (1899), No. 12, pp. 530–540*).—This is a brief review of the work of various investigators on this subject.

Analysis of Ceres soil, A. J. J. B. SIMONS (*Agr. Jour. Cape of Good Hope, 16 (1900), No. 4, pp. 218, 219*).—Analyses of 4 samples of soil collected in the Ceres Valley, Cape of Good Hope.

Analyses of samples of Siberian soils, A. SEMPOLOWSKI (*Ztschr. Landw. Versuchw. Oester., 3 (1900), pp. 81–122; abs. in Chem. Centbl., 1900, I, No. 15, p. 831*).—The soils examined were from the region of Omsk.

FERTILIZERS.

Fertilizing constituents of feeds recovered in the manure, W. R. PERKINS and E. B. FERRIS (*Mississippi Sta. Bul. 60, pp. 28–32*).—In connection with the feeding experiments referred to on page 1068, determinations were made of the fertilizing constituents in the various feeding stuffs used (Johnson grass, corn-and-cob meal, cotton seed, and

cotton-seed meal), and in the manure from the steers to which they were fed. The composition of the excrement was as follows:

Composition of excrement from steers.

	Nitrogen.	Potash.	Phosphoric acid.
	Per cent.	*Per cent.*	*Per cent.*
Steer No. 1:			
Dung (dry)	1.97	0.58	0.99
Urine	.45	99	.26
Steer No. 2:			
Dung (dry)	2.82	1.08	2.52
Urine	1.04	.87	29
Steer No 3:			
Dung (dry)	2.28	1 12	1.82
Urine	.92	.97	.20

On the average 84.4 per cent of the nitrogen, 92.5 per cent of the potash, and 86.4 per cent of the phosphoric acid of the feed was excreted in the manure. The comparative value of the feed and the manure is shown in the following table:

Comparative value of feeds and manure.

	Cost of feed.	Manurial value of feed.	Manurial value of excrements.	Manurial value of feed recovered in excrements.	Proportion of fertilizing value excreted in dung.	Proportion of fertilizing value excreted in urine.
	Cents.	*Cents*	*Cents.*	*Per cent.*	*Per cent.*	*Per cent.*
Steer No. 1	40 4	15 59	13 85	88.8	58.1	41.9
Steer No 2	39 2	27 21	23 05	84.7	50.0	50.0
Steer No. 3	34 3	22.61	19 23	85.0	56.9	43.1

Plat experiments on the action of lime and magnesia in burnt lime and marl, R. ULBRICHT (*Landw. Vers. Stat., 52 (1899), No. 5–6, pp. 383–430, figs. 7*).—From these experiments, which have extended over a number of years, the following conclusions are drawn:

Yellow lupines were generally injured by applications of lime even with an abundance of potash. The injury was especially marked when the lime contained 40 per cent of magnesia, the latter apparently being poisonous to the plants. Applications of such material also proved injurious to barley, vetch, and radishes (*Raphanus oleiferus*). Experiments with yellow lupines following radishes showed that the injurious effects of heavy liming extended over at least 2 years. Magnesia apparently increased the proportionate yield of grain in the case of lupines, barley, and other plants. Heavy applications of marl reduced the yield of lupines, but to a less extent than the burnt lime. Contrary to the conclusion of Heinrich the variation in the effects of the different calcareous manures was not removed by finely pulverizing them.

Notes on testing soils for application of commercial fertilizers, H. A. WEBER (*Jour. Amer. Chem. Soc., 21 (1899), No. 12, pp. 1095–1099*).—**The author gives various directions regarding the collection of samples**

of soil and describes the method used in making soil tests for farmers at the Ohio State University, as follows:

"Ordinary six-inch tiles are placed into large Wagner pots, which contain enough clean sand so that the top of the tiles will be on a level with the top of the pots. The whole is then filled with sand with the exception of the upper 7 in. of the tiles. The sand is then thoroughly drenched with rain or condensed water. The empty portion of the tiles are next filled to within an inch of the top with the thoroughly mixed sample of soil, the fertilizer is added and incorporated with the upper portion of the soil by stirring, moistened if necessary, 15 seeds of oats, spring barley, spring wheat, or other grain are distributed uniformly over the surface, and then covered with enough of the dry soil to bring the surface of the soil on a level with the top of the tiles. The six-inch tiles, to the depth of 7 in. as described, will contain about 10 lbs. or 5 kg. of soil.

"Five miniature plats are thus prepared for each soil test. If Wagner pots are not available, a box 18 in. deep with an opening in the bottom for drainage, and large enough to hold 5 of the tiles, may be employed. The sand surrounding the tiles is kept moist by adding water once a week.

"The amount and kind of fertilizer to be added to the 5 plats for each test are as follows:

Fertilizers applied in soil test.

	Superphosphate.	Potassium sulphate.	Sodium nitrate.
	Grams.	*Grams.*	*Grams.*
Plat 1 (complete fertilizer)	1.0	0.5	0.5
Plat 2 (complete mineral fertilizer)	1.0	.5	
Plat 3	1.0		.5
Plat 4		.5	.5
Plat 5 (no fertilizer)			

Observations on the growth of the plants during 5 or 6 weeks are considered sufficient to indicate the needs of the soil, and recommendations are made accordingly.

Report of chemist, M. B. HARDIN (*South Carolina Sta. Rpt. 1898, pp. 8–15*).—This is a brief statement of the work of the year in the following lines: The chemistry of the sea-island cotton plant, analyses of soils and crops used in rotation experiments, studies of the changes which the starch of sweet potatoes undergoes during storage, the composition of sugar beets grown in South Carolina, moisture determinations in soils and crops, the preparation of acid phosphates, fertilizer inspection, and examination of water, ores, etc.

"A sample of floats containing 62.17 per cent of phosphate of lime was, without any further grinding, found to yield an acid phosphate containing 15.67 per cent of available phosphoric acid. A sample of dried rock carrying 59.68 per cent of phosphate was found, after grinding so as to pass through a sieve of about 100 meshes to the inch, to give an acid phosphate containing 16.57 per cent of available phosphoric acid; while two samples, one of dried, the other of raw rock, containing respectively 52.98 and 52.74 per cent of phosphate, after passing through the 100-mesh sieve, gave acid phosphates containing respectively 14.29 and 14.84 per cent of available phosphoric acid. The investigation has shown that the character and grade of the acid phosphate from any particular phosphate rock depends largely upon the degree of fineness to which the sample is ground. The sulphuric acid used in the cases referred to was of 50° Baume, and had the temperature of the air. No drier was

> employed. In the case of the floats, the acid phosphate remained slightly damp for several days, becoming gradually hard and dry, but in the other cases the products were perfectly dry and easily handled in from 24 to 48 hours. No free sulphuric acid, or at most but a trace, was found in any of the acid phosphates."

The results of analyses of fertilizers inspected during 1898 have already been reported (E. S. R., 10, p. 624).

> "Of the 314 samples analyzed this year 6 were deficient under the present law, which requires only that the commercial value based upon results of analysis shall not fall 3 per cent below the commercial value based upon guarantee. In addition to these, however, there were 35 samples below guarantee in one or more constituents."

In all of the guaranteed samples (5) of cotton-seed meal the actual percentage of fertilizing constituents exceeded the amounts guaranteed.

Third biennial report of the director of the Missouri Experiment Station on the enforcement of the fertilizer-control law, H. J. WATERS (*Missouri Sta. Rpt. 1898, pp. 70–76*).—This includes an itemized statement of receipts and expenditures of the station on account of the fertilizer control, and tabulated analyses and valuations of 10 samples of fertilizers, representing 4 firms, examined during 1897, and 13 samples, representing 5 firms, examined during 1898, with notes on the trade values of fertilizers and on the amount sold in Missouri.

> "It is estimated that in 1898 the spring sales of fertilizers amounted to approximately 400 tons compared with 300 tons in 1896, consisting chiefly of blood and bone and complete goods, for use on garden truck, strawberries, orchards, potatoes, and corn. The bulk of these fertilizers was purchased by farmers, orchardists, and gardeners in the vicinity of our larger cities.
>
> "The fall sales are estimated to have reached 2,900 tons compared with 1,700 tons for the corresponding period in 1896, and consisted chiefly of raw and steamed bone goods with more or less blood added to bring up the nitrogen content, and in some cases with potash. Most of these fertilizers were applied to wheat.
>
> "Assuming that these fertilizers cost the consumer an average of $25 per ton, the farmers of Missouri invested in 1898 the sum of $82,500 for these materials during the year."

Molasses refuse fertilizer (Melasseschlempedünger), H. SCHMID (*Deut. Landw. Presse, 27 (1900), No. 12, p. 115*).—This material, which has been put on the market under the name of "chilinit," is a product, suited for transportation and for use as a fertilizer, prepared from dilute molasses refuse. It is stated to be of variable composition, but to contain about 3 per cent of nitrogen, 7 to 10 per cent of potash, 15 to 25 per cent of lime, and only a trace of phosphoric acid.

The utilization of stable waste, W. H. BIRCHMORE (*Jour. Soc. Chem. Ind., 19 (1900), No. 2, pp. 118–121*).—Practicable and scientific methods for handling and utilizing stable manure.

On night soil, P. CARLES (*Messager Agr. Midi, 1900, I, No. 2, pp. 70–72*).

Phosphoric acid in agriculture, G. SMETS (*Belg. Hort. et Agr., 12 (1900), No. 4, pp. 53, 54*).

Utilization as a fertilizer of distillery vinasse, V. DEVAUX (*L'Ing. Agr. Gembloux, 10 (1900), No. 9, pp. 573–575*).—It is claimed that this material makes a valuable fertilizer when neutralized with lime and supplemented by applications of phosphatic fertilizers.

The value of blast-furnace dust as a fertilizer, C. Pradel (*Oesterr. Ztschr. Berg u. Hüttenw., 48 (1900), p. 65; abs. in Chem. Ztg., 24 (1900), No. 16, p. 49*).—This material (*Gichtgasstaube*) was found to contain on an average from 4 to 5 per cent of potash and was used with very satisfactory results, especially on oats and barley. Injury from small amounts of sulphocyanid compounds which may be present may be avoided by applying the material from 1 to 2 months before the crop is planted.

The injurious effect of nitrate of soda containing perchlorates, A. Peiermann (*Bul. Sta. Agron. Gembloux, 1900, No. 67, pp. 5-8, pls. 2*).—In experiments with rye grown in glass pots containing 4 kg. of soil, nitrate of soda containing from 0.5 to 10 per cent of potassium perchlorate was applied at the rate of 800 kg. per hectare (714 lbs. per acre). The results indicate that nitrate of soda containing not more than 1 per cent of perchlorates may be safely used.

Fertilizer experiments, F. W. Dafert (*Ztschr. Landw. Versuchw. Oesterr., 3 (1900), pp. 81-122*).—An account is given of the conditions, methods of conducting, and results of demonstration experiments with fertilizers, carried out under the auspices of the Agricultural Society of Vienna in lower Austria during the year 1899. The results are discussed with especial reference to taxation and the economical use of fertilizers. The report contains tables and charts.

Comparative tests of chemical fertilizers, made in 1899 under the auspices of the Vaud Society of Agriculture, E. Chuard and C. Dusserre (*Soc. Vaud. Agr. Bul. No. 137, pp. 574-589*).

The fertilizer resources and the fertilizer industries of Alabama, B. B. Ross (*Tradesman, 43 (1900), No. 2, pp. 51, 52*).—This article discusses briefly the consumption of fertilizers in Alabama and the raw materials which this State furnishes for the manufacture of fertilizers.

Analyses of commercial fertilizers and manurial substances, C. A. Goessmann (*Massachusetts Hatch Sta. Bul. 63, pp. 26*).—This bulletin reports analyses of 272 samples of fertilizing materials, including wood ashes, muriate of potash, sulphate of potash, sulphate of potash and magnesia, bone, dissolved boneblack, acid phosphate, dissolved bone meal, steamed bone meal, spent boneblack, cotton-seed meal, sludge, soot, hen manure, muck, plaster and muck, and complete fertilizers; and of asparagus, velvet bean, and soils.

Analyses of commercial fertilizers, H. J. Wheeler and B. L. Hartwell (*Rhode Island Sta. Bul. 59, pp. 29-35*).—Analyses and valuations of 46 samples of fertilizers collected in Rhode Island during the year 1899.

FIELD CROPS.

Some experiments with subsoiling, B. C. Buffum and W. H. Fairfield (*Wyoming Sta. Bul. 41, pp. 21, figs. 4*).—The results of experiments in subsoiling for cereals and root crops, as a means of conserving the irrigation water applied, are reported for 3 years of work at the home station, 2 years at the Sheridan Substation, and 1 year each at the Wheatland and Sundance substations. One acre of land was used in the different tests, the whole area being plowed 8 in. deep and one-half of it subsoiled to a depth of 16 to 18 in. Wheat, oats, barley, corn, potatoes, sugar beets, and turnips were grown on both halves. Both parts of each plat were irrigated alike.

The yields were not uniform each year. On the whole the yield of wheat was slightly increased by subsoiling and the authors believe that under certain conditions subsoiling for this crop with irrigation might be profitable. Subsoiling was not found profitable, however, with oats, barley, or corn. Root crops made decided gains on the subsoiled plats and the results were better the second year than the first, but the third year after subsoiling the yields were less than those of either the first or second year, owing, probably, to the soil becoming packed. The authors believe that subsoiling may be recommended throughout the State generally for potatoes. The cost of subsoiling in these experiments varied from $3 to $6 per acre.

A comparison was made of the amount of water used in growing crops on subsoiled and nonsubsoiled land.

> "Under our conditions subsoiling has increased the amount of water needed to irrigate the land and apparently is of little value in conserving moisture. However, if no water could be applied by irrigation during the summer, the filling of the reservoir formed by subsoiling with moisture in the winter or spring by rainfall or irrigation would be beneficial."

In an experiment to determine the relative value of 2 light irrigations as compared with 2 light and 1 heavy irrigation for potatoes, the increase in yield, due to the additional heavy irrigation, was over 76 per cent on plowed land and 69 per cent on subsoiled land.

Experiments with crops, W. SOMERVILLE (*County Councils Cumberland, Durham, and Northumberland Tech. Education, Rpt. 7 (1898), pp. 3-38, 77-109*).—Fertilizer experiments were made with swedes, potatoes, oats, clover, hays, and crops in rotation on a number of farms in different counties. The details of the experiments are tabulated and the general results obtained are discussed.

With swedes, barnyard manure has given better results than city sweepings. Applications of from 10 to 12 tons per acre have proved more satisfactory than larger amounts. The addition of commercial fertilizers to barnyard manure has not given sufficiently increased yields with swedes to justify their use. When commercial fertilizers were used without barnyard manure, potash was the most effective element employed, the crop being increased more than threefold by its use in connection with sulphate of ammonia and superphosphate. Lime proved a poor substitute for kainit, and where used in the presence of potash it considerably reduced the yied. Superphosphate has uniformly given the best results of the different phosphatic manures employed, while sulphate of ammonia has proved the cheapest and most effective form of nitrogen.

Barnyard manure increased the potato crop nearly 5 tons per acre, and a still further increase of 1½ tons per acre followed the addition of complete commercial fertilizers to the barnyard manure. The effect of the potash in the complete fertilizers in prolonging the growing period of the potatoes is thought to be the main cause of this increase in yield. Muriate was the most effective of the different forms of potash applied. The use of potash tended to increase the percentage of large tubers.

Oats were grown on poor land after grass. The yields were more than doubled by the addition of complete commercial fertilizers. Bone meal used as a top-dressing for oats gave yields considerably inferior to those obtained by the use of relatively much smaller quantities of a mixture of superphosphate and nitrate of soda or sulphate of ammonia. Its residual effects were also small. The yield of oats increased from 3 bu. per acre without Alinit to 8 bu. per acre when it was applied. The yield on an adjoining plat receiving 125 lbs. of sulphate of ammonia and 200 lbs. of superphosphate was 30 bu. per acre.

The results obtained in experiments with clover lead to the conclusion that with a good "catch" the addition of nitrogenous fertilizers to the crop may prove highly unprofitable. On old hay land nitrate of soda has generally given better results than sulphate of ammonia, and basic slag has proven superior to superphosphate. Complex mixtures of fertilizers have given better results for hay than simpler though more costly mixtures. Applications of ground shells on hay fields have regularly resulted in loss. The importance of applying barnyard manure on hay lands in the fall is strongly emphasized. Cutting and raising the turf to a depth of 4 in. for the purpose of aeration resulted in decreased yields.

Barnyard manure applied to swedes in rotation experiments in 1894 materially increased the oat crop in 1897. The effect on the crop of oats of feeding off part of the preceding turnip crop with sheep getting hay and linseed cake rations was to increase the yield by 13 bu. of grain and 7½ cwt. of straw.

Report on experiments on the manuring of oats, hay, and potatoes, R. P. WRIGHT and J. W. PATERSON (*Glasgow and West of Scotland Tech. Col., Agr. Dept. Rpts., 1898, pp. 7–109, dgm. 1*).—Similar work in 1897 has been previously noted (E. S. R., 11, p. 332) and a synopsis given of the experimental work here reported with potatoes (E. S. R., 11, p. 640).

The fertilizer experiment with oats was conducted on 22 farms and the yields of both grain and straw obtained by the different methods of manuring are tabulated and discussed. From the results obtained, the author concludes that the quantity of superphosphate applied with 100 lbs. of nitrate of soda and 200 lbs. of kainit on oats should not exceed 400 lbs. per acre. Superphosphate proved a more effective source of potash for oats than basic slag applied in like amounts. Sulphate of ammonia proved superior in efficacy to nitrate of soda.

The effect of the fertilizers on the milling value of one of the varieties of oats grown was studied in detail, and these data are reported by A. N. M'Alpine. Scarcely any effect due to the different methods of manuring was apparent.

In the rotation experiments roots were grown on the different plats in 1896, followed by oats in 1897 and hay in 1898. Two methods of manuring have been practiced: (1) Applying all the fertilizers to the root crop and (2) applying the fertilizers to the different crops each year. The latter method has thus far given the best results. Some of the conclusions drawn from this experiment are as follows:

> "Soluble ammoniacal manures (or nitrates) should not be relied upon as a source of nitrogen to the turnip crop unless they are to be repeated. Slow manures, including dissolved bones, all applied to the turnip crop, give an intermediate though certain return throughout. It is unnecessary to reserve part of the bone meal for the oat crop, and, indeed, unprofitable. Basic slag is an uncertain manure on untried soils. It helps, however, the succeeding oat and hay crops, especially increasing the bulk of straw. Single manuring with slow manures can be profitably exchanged for repeated dressings of active fertilizers."

Some of the results obtained with the different fertilizers on hay may be summarized as follows: Basic slag applied alone is not a suitable manure for a rye-grass hay crop. Nitrate of soda is somewhat more effective for hay than sulphate of ammonia. A profitable increase of crop follows the use of either alone or both combined. Phosphatic and potash manures should always be used with these nitrogenous manures on most crops of grasses and clovers. Not less than 100 lbs. of muriate of potash should be applied with each 100 lbs. of nitrate of soda used. The efficacy of barnyard manure for hay is increased by supplementing it with nitrate of soda or sulphate of ammonia.

In experiments conducted on 2 farms to determine the effect of fertilizers on the production of rye-grass seed, it was found that the yield of seed was as certainly increased by the use of manures as was the increase of hay fodder. Basic slag used alone proved the least effective, and nitrate of soda and sulphate of ammonia, used either alone or combined, were the most effective of the commercial fertilizers tested. The addition of mineral fertilizers to the nitrogenous fertilizers still further increased the yield of seed and gave more profitable returns. "Farmyard manure alone, applied in the spring, proved of little value for the production of hay seed." Nitrate of soda and sulphate of ammonia were about equally valuable for the production of either hay or seed.

The relative value of green and yellow colored rye grains for seeding, P. HOLDEFLEISS (*Fühling's Landw. Ztg., 48 (1899), No. 14, pp. 536–540*).—Comments are made upon the experiments of others and those of the author are described at some length.

It appears that green-colored rye grains germinate quicker and have a greater germinative ability than yellow ones. The subsequent development of the plants showed no constant relation to color of grain, although the averages of all the plants from green-colored seed were less developed, the ears appeared later, and the plants were later in flowering. The water requirements of the plants were greater in the case of those from green-colored seed. The total yield of grain and straw was slightly in favor of the use of green-colored seed. The yellow-colored seed produced 89 per cent as much straw as the others, while the grain production from green-colored seed was 82.8 per cent of that from yellow-colored seed. It is stated that the yellow kernels have a greater tendency to transmit their character upon later generations than green ones, and in breeding and improvement experiments with rye this factor is of importance.

Corn culture, R. J. REDDING (*Georgia Sta. Bul. 46, pp. 59-75*).—Cultural, variety, and fertilizer tests with corn are reported. The experiments are in continuation of those previously noted (E. S. R., 11, p. 29). Detailed directions for corn culture, based on the results of ten years' experience in corn growing at the station, are appended.

In 1899, 19 varieties of corn were tested. Unfavorable weather decreased the yield so that scarcely half a crop was harvested. The results of previous variety tests with corn at the station are tabulated and averaged. The varieties Mammoth Yellow, Cocke Prolific, Sanders Improved, Higgins, and Shaw Improved, in the order named, have given the best results of the varieties tested at the station for a number of years.

In experiments to test the value of increasing amounts of fertilizers for corn it was found that on the station soil the yields of shelled corn were not at all increased by doubling or tripling a normal application of 336 lbs. of complete commercial fertilizer per acre. Based on these results the author advises the use of not more than 200 or 300 lbs. of complete commercial fertilizer per acre for corn on high dry uplands.

The residual effects of excessive amounts of nitrogenous fertilizers applied to cotton in 1898 were observed on the corn crop grown on the same ground in 1899. Plats on which cotton seed meal had been used were the only ones which gave increased yields of corn. The general results of the test indicate the nonadvisability of applying excessive amounts of nitrogenous fertilizers to a crop of cotton in expectation that the following crop of corn will be benefited by it.

The results of the experiment to test the relative value of planting corn at different distances in the row were in accord with those of previous years, *i. e.*, planting 4 by 3 ft. gave the best results. In another similar experiment it was found that when 3,630 stalks were grown per acre, the more nearly the spacing between the plants approached a square the better the results.

In a test of different nitrogenous fertilizers furnishing equal amounts of nitrogen, little difference was found whether the source of the nitrogen was nitrate of soda, cotton seed meal, or dried blood. Nitrogen in the form of cotton-seed meal, however, was considerably cheaper than in the other forms.

Harvesting the entire stalk of corn at the usual time in August has been found more economical than letting the stalks stand and harvesting only the ears in October.

Hungarian brome grass (Bromus inermis), T. L. LYON (*Nebraska Sta. Bul. 61, pp. 35-63*).—A botanical description is given of this plant, with an account of culture and pasture experiments at the station and cooperative culture tests throughout the State, and directions for growing the crop, based upon experiments at the station and elsewhere.

In one test at the station, *Bromus inermis* formed a part of a mixture of white, red, and alsike clover, Russian red clover, blue grass, and timothy. By the second year the brome grass had crowded out everything except the red clover. In the spring of 1898, 15 acres were sown in brome grass, on April 2 and April 27. The following season 1.26 tons of hay per acre was cut from a portion of the field, and 177 lbs. or 12.6 bu. of seed per acre was obtained from another portion. A portion kept for pasture was relished by stock. The results from seeding on different dates were practically identical.

A pasture test was made of brome grass for milch cows. Two cows which had been pastured on mixed grasses were placed on separate plats of brome grass aftermath, in one instance 7 days and in the other 10 days, after which they were again pastured on mixed grasses. Separate records of the milk and butter yields of the 2 cows were kept during each period. The results in one instance showed the brome grass to be equal to mixed-grass pasture for milk and butter production, but in the other the results were not so favorable to brome grass. The tests showed, however, that brome grass made a very good quality of pasture.

Chemical analyses were made of brome grass when in full bloom and of rowen when about 12 in. high. The following table shows this data, calculated to water-free material, with analyses of timothy and barley hay for comparison:

Analyses of Bromus inermis and of timothy and prairie hays.

	Bromus inermis		Timothy hay.	Prairie hay.
	Full bloom	Rowen.		
	Per ct	*Per ct*	*Per ct*	*Per ct*
Ash	10.65	13.65	7.39	8.34
Crude fiber	34.71	26.23	34.39	32.40
Crude protein	13.09	18.56	8.84	6.27
Ether extract	2.01	5.69	3.58	2.60
Nitrogen free extract	39.54	35.87	45.80	50.39
Total nitrogen	2.09	2.97	1.42	....
Albuminoid nitrogen	1.70	2.40	1.14	....

Seed of Hungarian brome grass was distributed throughout the State in the spring of 1898 largely to members of the Agricultural Students' Union. Reports from 32 experimenters on the growth during the 2 years have been received. These are incorporated in the bulletin. The conclusions drawn from the work thus far conducted with brome grass are as follows:

"*Bromus inermis* is, all things considered, the most promising cultivated pasture grass for this State that has been tested on the station farm. After once having become established it is unaffected by cold. During periods of extreme drought it lessens growth but does not die. Its advantages over our native grasses are that it becomes green fully a month earlier in the spring and does not dry up in the summer. It also remains green late in the fall. Indications are that it will carry more stock to the acre than most of our prairie pastures. It does not make a good mixture with other grasses, but does well with red clover. As a pasture for dairy cattle it is not equal to a mixture of blue grass and white clover, nor by any means equal to alfalfa as a milk and butter producer, but it is absolutely safe. Chemical analyses of the hay indicate that it is equal to lowland prairie hay for feeding purposes. Tests of the grasses at various points throughout the State, from Pawnee to Dawes County, and from Dundy County, point unmistakably to the fact that it is adapted to a greater range of territory than any other cultivated grass."

Experiments with field and forage crops, F. E. EMERY (*North Carolina Sta. Bul. 168, pp. 421–434, fig. 1*).—This bulletin gives the results of some work in seeding pastures, testing varieties of cotton and wheat, seeding timothy, improving peanuts, and certain notes on the growth at the station of sachaline (*Polygonum sachalinense*) and prickly comfrey (*Symphytum asperrimum*), and on miscellaneous permanent station improvements.

In the experiments with peanuts a lot of Virginia seed was separated into 1-celled, 2-celled, 3-celled, and 4-celled pods and the different lots shelled and planted. The object of the experiment was to see what influence the seed from the different sources would have on the size of the pods of the resulting crop. The results are tabulated for each lot of pods and are remarkably alike. About 5 per cent of each lot grown was 1-celled, 30 per cent 2-celled, 50 per cent 3-celled, and 15 per cent 4-celled. The crop obtained from seed from the 1-celled pods contained a slightly larger percentage of 3-celled pods than any of the other lots and practically as large a percentage of 4-celled pods as the crop obtained from planting seed of 4-celled pods.

Of the 2 varieties of cotton tested, King yielded 186.6 lbs. at ginning and Anson Queen 198.5 lbs.

The results obtained with sachaline were such as to recommend its use for soiling purposes, but not for general farming. Of 16 varieties of wheat tested, Fauntleroy made the best yield, 27.89 bu. per acre in one instance and an average of 20 bu. per acre in a field of 90 acres.

Cooperative range grass and forage plant experiments at Highmore, S. Dak., F. LAMSON-SCRIBNER (*U. S. Dept. Agr., Division of Agrostology Circ. 21, pp. 10, fig. 1*).—These experiments are being carried on by this Department in cooperation with the South Dakota Agricultural Experiment Station. A large number of grasses and forage plants are being grown to test their adaptability for culture in that region. The plan of the experiment and the results of the first year's work are reported, and notes are given on each of the different grasses and forage plants grown.

"The pressing need of this section of the country is winter feed, either hay, fodder, or pasture. Some of the bunch grasses from the higher altitudes in Wyoming and Montana, such as bunch redtop (*Poa buckleyana*) and smooth bunch grass (*Poa lævigata*), give much promise for winter pasture, while Nevada blue grass (*Poa nevadensis*) and King's fescue (*Festuca kingii*) give promise of both hay and pasture. The frost does not affect them until very late in the season. The favorable growth and behavior of smooth brome grass (*Bromus inermis*) this year, as well as previous experience here and elsewhere in the Northwest with this grass, shows it to be a good hay and pasture grass. On the highest, driest ground of the station it made a good stand and kept green and thrifty during the driest weather. Oregon brome has made a fine showing and deserves a thorough trial on account of its excellent yield of seed and forage, and drought-resistant qualities. The native wheat grasses furnish the larger percentage of the hay in this section and under cultivation and favorable conditions will undoubtedly increase in productiveness.

"Some of the millets introduced from the plains of Russia and some of the varieties of sorghum and fodder corn indicate the possibility of obtaining profitable returns in forage for winter use."

Experiments in range renovation are also under way. "The difference already seen where there has been a summer's rest should be an object lesson to every stockman."

Experiments with forage plants in Ontario, P. B. KENNEDY (*U. S. Dept. Agr., Division of Agrostology Circ. 20, pp. 3*).—A brief report on a portion of the proceedings of the meeting of the Ontario Agricultural and Experimental Union held at Guelph, Ontario, December 6–8, 1899.

In 1899, 23 different experiments were carried on under the direction of the Union by 3,485 experimenters, 739 of whom sent in satisfactory reports. Experiments with grasses showed that the best yield was obtained during the second year's growth. Tall oat grass gave the best yield of the 4 grasses tested. Mammoth clover produced larger amounts of hay per acre than either common red clover, alsike, or alfalfa. Hairy vetch proved the most productive of 3 vetches tested. Medium Green soy beans gave larger yields of both straw and grain than American Coffee Berry or Extra Early Dwarf. Only one crop of soy beans can be grown in Ontario during the season. Of the millets grown, Japanese Panicle heads the list, with 6.4 tons of green hay per acre. The value of crimson clover as a cover crop is pointed out and sustained with figures.

Smooth brome grass, P. B. KENNEDY (*U. S. Dept. Agr., Division of Agrostology Circ. 18, pp. 9, figs. 2*).—Brief historical and descriptive notes on brome grass (*Bromus inermis*), with remarks on methods of seeding in different States, on the value of the plants for pasture and hay, hardiness and drought-resisting powers, and on the distribution of brome-grass seed by this Department. Some results of tests with the grass in 40 States are noted, with brief reports from different growers showing the adaptability of the grass to varying climatic and soil conditions. "It has remarkable drought-resisting qualities and is the most suitable grass yet introduced for the dry regions of the West and Northwest. When once established, it will withstand a temperature of many degrees below zero without being injured."

Grass and forage plant investigations on the Pacific Coast, F. LAMSON-SCRIBNER (*U. S. Dept. Agr., Division of Agrostology Circ. 22, pp. 7*).—This gives a synopsis of the work carried on by this Department to increase the grazing and forage capacity of the ranges east of the Cascades, and also of work on the planting of certain grasses as sand binders. This work has been carried out in cooperation with railroads at Yakima and at Walla Walla, and at various points along the coast and the Columbia River.

In the range experiments about 150 varieties of grass have been tested, some 25 or more showing themselves adapted to the conditions prevailing in the Northwest. Among these common clovers, especially alsike and mammoth red, meadow fescue and tall oat grass have given good results.

"Smooth brome grass has produced the same excellent results here that it has given elsewhere in the Northwest, and gives promise of being to the drier section of this region what the blue grass is to Kentucky and timothy is to the Northern States. Of the more recent introductions the Japanese wheat grass promises to be of great value, particularly for winter pasturage, while the varieties of alfalfa from Turkestan and Northern Africa seem to possess great powers of adaptability to the conditions which prevail in the semiarid regions.

"Some of the best results have been secured from our native grasses. A species of brome, closely related to the rescue grass, has given good yields of seed and forage, and seems likely to prove as valuable for the Pacific coast as rescue grass is for the South. Several of the native wheat grasses show wonderful adaptability to cultivation, and are destined to assume an important place on our list of forage-producing plants. Four of these deserve especial mention, namely, western wheat grass (*Agropyron spicatum*), meadow wheat grass (*A. pseudorepens*), slender wheat grass (*A. tenerum*), and bunch wheat grass (*A. divergens*). The first 3 species are suitable for meadows, and may be grown either with or without irrigation. The bunch wheat grass is a native of the dry uplands, and is likely to prove one of the best grasses for reclaiming the worn-out ranges. The plants thrive under conditions of extreme drought, and afford excellent pasturage for all kinds of stock. . . .

"Another native grass which does well under cultivation and which will undoubtedly prove valuable in reseeding the ranges is blue grama, known in Montana as buffalo grass. . . .

"Of the annual grasses Japanese barnyard millet and black Russian broom-corn millet are most deserving of special mention. Both of these made excellent yields of forage and seed and are of undoubted value to this section."

Some 20 other sorts of grass were successfully grown at Walla Walla and 20 more gave results of sufficient promise to deserve further study and experimentation.

Of the sand-binding grasses, Marram grass, bitter panic grass (*Panicum amarum*), and reed canary grass (*Phalaris arundinacea*) have given promising results. Small sand lyme grass (*Elymus arenicolus*), seaside blue grass (*Poa macrantha*), and Indian millet (*Eriocoma cuspidata*) are other sand-binding grasses of much promise.

The Australia saltbush (*Atriplex semibaccata*) has given the best results of any of the introduced saltbushes, while the white or sweet sage (*Eurotia lanata*) is the most promising of the native series.

In November a study was made at Walla Walla of the behavior of certain grasses and forage crops toward early frosts, the results of which are reported.

Sugar-beet experiments of 1898, G. W. SHAW (*Oregon Sta. Bul. 59, pp. 21, pls. 3*).—This is in part a continuation of work already reported (E. S. R., 10, p. 544). The bulletin sets forth the results obtained in the experiments of 1898, together with observations on the beet-sugar industry now established at La Grande by the erection of a factory. The bulletin also presents the conclusions reached after five years of investigation on the production of beet sugar in Oregon. These conclusions are in part as follows:

> "Three sections of the State are exceptionally well adapted to the industry, viz, Union County, in the vicinity of La Grande; Malheur County, in the vicinity of Ontario and Arcadia; Jackson County, in the vicinity of Medford. Western Oregon is not well adapted to the industry on account of the early fall rains and a soil which is very heavy and sticky, and tenacious to the beet when wet, and it also lacks a cheap lime supply. The Original Kleinwanzlebener and the Elite Kleinwanzlebener have proven themselves well adapted to the conditions in the Grande Ronde Valley, and both have given good results in Jackson County. The former has given the better results in the latter place. Each has given better results in each place than the Vilmorin. In eastern Oregon beets may be left in the ground quite late without serious loss from second growth. Beets for sugar production should not be planted on alkali soils. Beets may be allowed to grow much larger here than in Germany and still hold an excellent percentage of sugar. The hill lands of Jackson County are not well adapted to the industry. The establishment of a sugar factory makes possible a most excellent opportunity for a high development of the dairy industry."

Analyses are given of beet pulp, and notes are given on its use as a food for cattle.

New Mexico sugar beets, A. GOSS and A. M. HOLT (*New Mexico Sta. Bul. 29, pp. 182-212, dgm. 1*).—The work of 1898 was limited to such localities in the State as were supplied with sufficient irrigable land, water, fuel, and limestone as to justify the culture of sugar beets on a commercial scale and the establishment of sugar-beet factories, if it should be found desirable. The results for 1898 demonstrated the advisability of planting in most localities by the first of May, and allowing 5 months for the beets to mature. The average amount of sugar in the juice was 16.5 per cent, with a purity of 82.1 per cent. Beets from Santa Fé County averaged 18.69 per cent of sugar in the juice, with a purity coefficient of 82.1 and an average weight of 1.1 lbs. In San Juan County the data were as follows: Average sugar in the juice, 17.63 per cent; purity, 88.5 per cent; weight of beets, 1.2 lbs. The sugar beets grown at the station were a failure, so far as satisfactory sugar content and purity were concerned.

The Vilmorin and Kleinwanzlebener varieties were planted May 1 and June 1 at three different places in the State, and portions of the beets harvested October 1, November 1, December 1, and January 1 and compared. The results are tabulated. Kleinwanzlebener beets planted May 1 averaged somewhat more than 1 per cent higher in sugar content than the Vilmorin variety planted at the same time, but the Kleinwanzlebener beets planted June 1 averaged between $\frac{1}{4}$ and $\frac{1}{2}$ per cent lower than the Vilmorin variety planted at the same time.

The effect of transplanting beets was tested. "In general the transplanted beets were smaller than the others, and the roots showed a tendency to double up against the beet instead of entering the ground and forming well-formed beets. The principal value of transplanting would be doubtless in filling out the blanks resulting from a poor stand."

The factory conditions of New Mexico are explained and analyses given of 5 of the best well waters of the Missoula Valley, of the Rio Grande River for each month during 1894, and of samples of water from 5 parts of the State where good sugar beets have been grown. Analyses are also given of 10 different samples of limestone from as many different sections of the State.

Instructions for growing sugar beets are reprinted (E. S. R., 10, p. 246), and a bibliography given of recent sugar-beet bulletins.

Wheat-culture experiments, 1898–99, G. E. MORROW and J. H. BONE (*Oklahoma Sta. Rpt. 1899, pp. 33–36*).—The average yield of the 13 varieties of wheat grown at the station during the season was 22.8 bu. per acre. German Emperor and Sibley New Golden each yielded over 27 bu. per acre. Next in order came Fulcaster, Early Ripe, and Red Russian. Turkey gave the lowest yield by nearly 6 bu. of all the varieties grown, 14.7 bu. per acre. The best yielding varieties for the preceding 4 years were Sibley New Golden, 30.7; Missouri Blue Stem, 30.3; Nigger, 29.8; Early Red Clawson, 29.1; Big English, 28.8; and German Emperor, 28.6 bu. per acre.

In the opinion of the authors the results of these tests indicate that wheat can be profitably grown in Oklahoma on the prairie soils. Five pecks of seed has been found a safe quantity to sow per acre, and sowing in September more satisfactory than later seedings.

The influence of neighboring plants on the yield and quality of the crop, STREBEL (*Fuhling's Landw. Ztg., 49 (1900), Nos. 1, pp. 1–6; 2, pp. 41–45; 3, pp. 81–83*).—This records the details of some plat experiments made to determine the effects of planting low-growing and high-growing plants beside each other. Oats, corn, clover, beans, cabbage, and beets were the crops used; and the effects of shade, lodging of the crops, and the withdrawal of water by neighboring plants on the yield and quality of the different crops were the principal features studied.

The chemical change of rye and wheat by mold, R. SCHERPE (*Ztschr. Untersuch. Nahr. u. Genussmtl., 3 (1900), No. 3, pp. 166, 167*).—A controversial article.

The maintenance of soil fertility through the growth of legumes, F. T. SHUTT (*Jour. Agr. and Hort., 3 (1900), No. 21, pp. 485–488*).—The increased results obtained by growing barley, oats, corn, and potatoes after clover are given.

Experience notes upon plat experiments, B. D. HALSTED (*Science, n. ser., 11 (1900), No. 280, pp. 726–732*).—Notes on factors in conducting plat experiments which tend to vitiate results.

Results obtained in the experimental fields of Haute-Marne, M. E. CASSEZ (*Sta. Agron. Nancy Bul. 1, 1899, pp. 37–39*).—Brief report on cultural and fertilizer experiments at the station (1897) with wheat and oats.

Summary of results of experiments with field and orchard crops, J. FIELDS (*Oklahoma Sta. Rpt. 1899, pp. 46–70*).—In this summary are brought together results thus far obtained at the station in variety and cultural tests with wheat, corn, Kafir corn, cotton, castor beans, oats, alfalfa, cowpeas, stock melons, sugar beets, apples, pears, apricots, plums, cherries, peaches, grapes, and nut bearing trees. Notes included in the summary on keeping up fertility and on cultivation and soil moisture have been previously noted (E. S. R., 10, p. 348; 11, p. 433), as have the data for practically all the other crops noted.

Report of the work of the agricultural department, J. D. TOWAR (*Michigan Sta. Rpt. 1898, pp. 121–125*).—A brief review of the work of the year with wheat, oats, corn, and certain forage crops. A plan is given of some fertilizer experiments under way on muck land. Dawson Golden Chaff gave the best yield of wheat recorded during the year, 42.59 bu. per acre. Original seed of Dawson Golden Chaff yielded at the rate of 30.18 bu. per acre.

Winter vetch (*Vicia villosa*) has proven an excellent winter and early spring crop for green manuring, though it seems to be an undesirable food for cattle. Sorghum, Kafir corn, Bedouian corn, pearl millet, and velvet beans also made a good growth at the station.

Rotation tests, S. M. EMERY (*Montana Sta. Bul. 20, pp. 113–118*).—A report is made of the results obtained the first year in a six-year rotation test carried on under actual field conditions with straw and field peas, Canada field peas, barley, sugar beets, oats, red clover, and spring wheat. An account is also given of a test of a land leveler. The use of this instrument is recommended especially on land which has become uneven in the course of tillage.

Alfalfa in eastern Kansas, H. M. COTTRELL, D. H. OTIS, and J. G. HANEY (*Kansas Sta. Bul. 90, pp. 4*).—A popular bulletin calling the attention of farmers in the eastern part of the State to the value of alfalfa as a farm crop. Cultural directions are given, especial attention being paid to methods of seeding alfalfa.

Turkestan alfalfa, N. E. HANSEN (*Amer. Agr.* (*mid. ed.*), *65* (*1900*), *No. 8, p. 232*).—A description of the plant in the United States, with an estimate of its value from a Russian standpoint.

Turkestan alfalfa (*Pacific Rural Press, 59* (*1900*), *No. 3, p. 37*).—Notes on this plant, with the history of its introduction into the United States.

The planting of fodder beets, VON SEELHORST (*Deut. Landw. Presse, 27* (*1900*), *No. 19, pp. 217, 218*).—According to the author's investigations, extending over a period of two years, large plants are better for transplanting than small ones and cutting away the leaves at the time of transplanting to within an inch of the root is a harmful practice.

Cultural worth of American red clover, KIRCHNER (*Deut. Landw. Presse, 27* (*1900*), *No. 15, p. 165*).—A comparison was made at Leipsic of the relative value for hay of American and Bohemian red clover seed. The total yields for each of 3 seasons were in favor of the American seed and but little difference was observable in the food constituents of the 2 clovers. The American clover seed was purchasable in seed markets at a considerably lower price than European grown seed.

Cassava convention (*Florida Agr., 27* (*1900*), *No. 1356, pp. 81, 82*).—Synopsis of papers and discussions presented to the convention at Sanford, Fla.

Divi-divi pods (Cæsalpinia coriaia) (*Agr. Ledger, 1899, No. 10* (*Veg. Prod. ser. No. 51*), *pp. 1–19*).—An article on the cultivation of the plant in India and the value of the pods as a tanning material, with notes on 3 samples obtained from Bengal.

Two new fodder plants for Virginia (*Rural New Yorker, 59* (*1900*), *No. 2613, p. 122, fig. 1*).—Spelt (*Triticum spelta*) and its adaptability to Virginia are especially considered.

Some new grasses from the Southern States, G. V. NASH (*Bul. New York Bot. Gard., 1* (*1900*), *No. 5, pp. 429–436*).—Name, description, and locality of 11 new grasses.

Fertilizer experiments with sulphate of ammonia on meadows, E. KLOEPFER (*Fühling's Landw. Ztg., 49* (*1900*), *No. 3, pp. 107–113, fig. 1*).—The use of 400 kg. of sulphate of ammonia per hectare practically doubled the yield of hay.

Experiences in the application of potash fertilizer on artificial and natural meadows, E. MARRE (*Prog. Agr. et Vit.* (*Éd. L'Est.*), *21* (*1900*), *No. 2, pp. 58–62*).

Culture of mixed oats (*Sta. Agron. Nancy Bul. 1* (*1899*), *p. 39*).—A mixture of 2 choice varieties of oats gave better yields than either of the varieties grown separately.

Potato trials, L. S. SPENCER (*Amer. Gard., 21(1900), No. 270, pp. 128, 129*).—A report is given of tests of 50 varieties in 1899. From the results of the tests, the author recommends the following varieties for general planting: Acme, Early Michigan, Late Norther, State of Maine, Livingston Banner, Livingston Pink, and Gem, ripening in the order named.

The principles and practice of potato culture, L. S. SPENCER (*Amer. Gard., 21 (1900), Nos. 275, pp. 220, 221, fig. 1; 276, pp. 242, 243, fig. 1; 280, p. 314*).—Part 1 of this article deals with the selection of the seed for planting, part 2 with the details of planting and cultivation, and part 3 with harvesting, marketing, and storing.

Potato experiments in Cheshire (*Jour. Hort., 52 (1900), No. 2678, pp. 85, 86*).—From the results of these experiments it is concluded that large potatoes for seed are better than small; sulphate of ammonia is the best form of nitrogen for potatoes. Care must be taken not to use too large amounts of potash.

The degeneration of potatoes and selection at the time of digging, J. BERTHONNEAU (*Semaine Agr., 20 (1900), No. 973, pp. 5, 6*).

Ensiling potatoes (*Queensland Agr. Jour., 6 (1900), No. 2, pp. 82–84*).—A résumé of the work done on the subject in different countries.

Ramie, L. DE BALESTRIER (*Prog. Mexico, 7 (1900), No. 304, pp. 241, 242*).—History and description of this plant in Mexico.

Monograph on rice, G. D'UTRA (*Bol. Inst. Agron. São Paulo, 10 (1899), Nos. 8, pp. 469–513; 9–10, pp, 611–625*).

The culture of rice in Cambodia, A. LECLERC (*Rev. Sci., 4. ser., 13 (1900), Nos. 1, pp. 11–15; 4, pp. 97–105*).

Rice culture in southwest Louisiana, C. U. LAITOR (*Amer. Thresherman, 2 (1900), No. 10, pp. 12–16*).—The method of rice culture successfully followed in southwest Louisiana and southeast Texas is described.

Origination of the Petkus rye, F. v. LOCHOW (*Fühling's Landw. Ztg., 49 (1900), Nos. 1, pp. 28–37, figs. 2; 2, pp. 45–53, figs. 3*).—The details of the author's method of procedure in securing this improved variety of rye are given, together with some of the results obtained.

Notes on sugar-cane experiments, J. B. HARRISON and G. S. JENMAN (*West Indian Bul., 1 (1900), No. 2, pp. 159–172*).—Suggestions as to the use of different manures in cane-growing experiments and in the improvement of varieties.

Experiment in manuring wheat at Coolabah farm, R. W. PEACOCK (*Agr. Gaz. New South Wales, 11 (1900), No. 2, pp. 146–149*).—A comparison of phosphates.

Experimental manuring, A. N. PEARSON (*Jour. Agr. and Ind., South Australia, 3 (1900), No. 7, pp. 562, 563*).—Wheat on fallow land without fertilizers yielded at the rate of 12⅙ bu. per acre. When 20 lbs. of "concentrated" superphosphate per acre was added the yield was increased to 18¼ bu. per acre. The net profit was increased by the use of the superphosphate $2.47 per acre.

Resistance of wheat to frosts, L. THIRY (*Jour. Agr. Prat., 1900, I, No. 7, pp. 235, 236*).—Data as to the effects of frost on 56 varieties of winter wheat.

Wheat for edible pastes in France, J. C. COVERT (*U. S. Consular Rpts., 62 (1900), No. 234, pp. 301, 302*).—Two bushels of Texas-grown wheat of the Nicaragua variety was distributed among different manufacturers of edible pastes in France, who subjected it to careful examination for paste-making purposes. All reports were very favorable.

The world's wheat lands—can we increase their production? H. F. MOORE (*London: The Author, 1899, pp. 8*).—Popular pamphlet dedicated to the Ministers of Agriculture of Canada and the United States, and to the directors of experiment stations in these countries. The future yields of western and northwestern wheat fields are considered.

Conversion through selection of winter Squarehead wheat to summer wheat, A. KIRSCHE (*Deut. Landw. Presse, 27 (1900), No. 15, pp. 166, 167, figs. 4*).—By spring planting winter Squarehead wheat and selection for a number of years a very satisfactory summer variety of wheat has been obtained. Details as to measurements and weighings of the original and selected seed are given, together with natural-size photographs of the new wheat.

The improvement of cereals by cross breeding (*Farmers' Gaz., 59 (1900), No. 8, p 150*).—Methods followed by T. R. Garten and brother in cross breeding wheat at Newton-Le-Willows are briefly noted. *Triticum spelta* has been crossed with an easy shelling cultivated variety of wheat. A cross has been secured with tough heads and tenacious chaff which retains the grain under all atmospheric conditions, even after the wheat becomes dead ripe. The ripe grain is easily obtained by threshing or other mechanical means.

Steam cultivation, J. L. THOMPSON (*Agr. Gaz. New South Wales, 11 (1900), No. 11, pp. 32–35*).—Systems of steam cultivation are discussed and a comparison made of the relative economy of steam, horse, and bullock cultivation.

HORTICULTURE.

Fertilizer and irrigation experiments with popular crops and under glass, A. T. JORDAN (*Amer. Gard., 21 (1900), Nos. 264, p. 22; 265, pp. 38, 39*).—In a paper read before the New Jersey Horticultural Society, at its meeting January 5, the author gives details and results of some field experiments at the New Jersey State Station with asparagus, blackberries, raspberries, currants, gooseberries, strawberries, and certain orchard fruits, in which different fertilizers were used, with and without irrigation. Lettuce and tomatoes were grown on different soils under glass surface and subsurface watering practiced. The experiments have been carried on since 1896, and some of the details have been previously noted (E. S. R., 9, p. 649; 10, p. 433; 11, p. 735). Rows 160 ft. long and divided into 4 equal sections, differently fertilized, were used for each of the different varieties of fruits and vegetables. From 2 to 6 irrigations were required in the different years. Some of the more striking results with the different crops may be noted.

Asparagus.—Six varieties were grown. The first 3 cuttings were taken as representing the early yield.

> "In all cases irrigation has increased the early yield. Combining all lots the increase in favor of irrigation equals 8.4 per cent. In total yields those plats receiving the commercial fertilizers have given, where irrigated, an increase of 9.2 per cent. Where the barnyard manure is used, a decrease occurs under irrigation, equivalent to 4.8 per cent Of the different fertilizers the complete fertilizer alone has given the largest early yield in every case, exceeding any other plat by 17.2 per cent. Relatively, also, the effect of irrigation upon the early yield has been greater where the complete fertilizer has been used alone than upon any other plat. Barnyard manure, where irrigated, has given the smallest increase in the early product. In total yields, the barnyard manure plats gave slightly the larger yields. . . . Relatively, the increase in total yield due to irrigation is greatest on the plat where the nitrate is added. The nitrated plats have, however, given the lowest yields. . . . .
>
> "Palmetto has given the largest yields throughout. It exceeds by 23.6 per cent any other variety in early yield, and by 21.6 per cent in total yields. Donald Elmira is second in yield and Columbian Mammoth White third. Conover Colossal yields the lowest in early cut, with Bar Mammoth lowest in total yield. . . .
>
> "The top growth the first two years was very much larger on the selected crowns than with the same varieties set with commercial roots. However, for the 4 seasons' growth the difference in favor of the selected crowns of Elmira has steadily

decreased and the past season it was small. With Palmetto the difference has grown a little larger each year except the past, when the tops from the selected crowns weighed less than those from the ordinary commercial roots."

Blackberries.—Irrigation increased the early yield of blackberries 39.2 per cent and the total yield 50.2 per cent.

"Relatively, the greatest increase due to irrigation in both early and total yields occurs upon the barnyard-manure plats.

"Where not irrigated, the complete fertilizer with bone and potash gives the largest early yield and also the largest total yield. The barnyard-manure plat gives the lowest returns in both cases. Where irrigated, the plat having the complete fertilizer alone is first in early yield and barnyard manure second. . . .

"In early maturity (yield of first 3 pickings) Early Harvest stands first, with Agawam second Agawam is, however, a most prolific variety, giving a little over ¼ (26.2 per cent) more fruit than Eldorado, the second in yield. Relatively, the effect of irrigation has been greatest with the Eldorado, amounting to 161.6 per cent of that obtained when unirrigated. Agawam is by far the most productive sort when unirrigated, but where irrigated it is but slightly better than Eldorado. These 2 varieties together have given a little over ¾ as much fruit as the other 4 varieties grown."

Raspberries.—Irrigation increased the early yield of raspberries 14.4 per cent and the total yield 19.9 per cent. The plat fertilized with barnyard manure and irrigated gave the largest early yield and also the largest total yield, the increase amounting to a little over ⅓ that obtained from the duplicate plat not irrigated. The plat which received nitrate of soda in connection with complete fertilizer, bone, and potash, gave the lowest yields throughout, though the relative rate of increase due to irrigation was largest on these plats. Only red varieties were tested. Cuthbert gave the largest yield of fruit; Marlborough was a week earlier, and gave the largest relative increase of fruit due to irrigation.

Currants and gooseberries.—Irrigation increased the yield of currants in all cases, the total yield being 25 per cent greater than where no irrigation was used. The barnyard-manure plat gave the lowest yield with irrigation. On the plats not irrigated the best yields were obtained from the complete fertilizer, with the addition of nitrate of soda. With irrigation these plats gave the lowest yields.

There was not much choice of varieties between Red Dutch and Victoria, although Red Dutch had a little larger berry and gave the greater increase due to irrigation. Fay Prolific has thus far failed to give any increase with irrigation.

Irrigation increased the yield of gooseberries in one instance only—on the plat fertilized with the commercial mixture alone. The largest total yields were obtained from plats fertilized with barnyard manure.

Strawberries.—Irrigation increased the strawberry yield as a whole 11 per cent. The best results were obtained from the plat fertilized with complete commercial fertilizers applied at the rate of 500 lbs. per acre. One of the conclusions derived from this experiment is that it is inadvisable to apply nitrate of soda in connection with a fertilizer already rich in nitrogen for strawberries. With low-grade fertilizers, its use is beneficial.

Lettuce.—Lettuce was grown in the greenhouse in a well-prepared forcing soil alone and with fertilizers in a sandy soil and in a clay soil. Different commercial fertilizers were used. The best results were obtained in the unfertilized forcing soil. It is believed that commercial fertilizers are of little use in the forcing house; "A thoroughly enriched sandy loam seems to provide for the wants of the forcing crop in the best possible manner." Subwatering gave an increase in yield on the forcing soil plat of 7.4 per cent. Solid beds were found more satisfactory than benches, as they dried out more slowly and required less watering.

Tomatoes.—Tomatoes were grown under glass, and 1½, 2, 2½, 3 and 3½ sq. ft. of surface given to each plant. The plants given 2½ sq. ft. each gave the largest total yields, but those given 2 sq. ft. each gave the largest total yields relative to the space occupied, and it is believed that this is the best distance for forcing this crop. Subwatering greatly increased the yield of tomatoes. Barnyard manure proved superior to commercial fertilizers as a plant food for this crop. Surface watering was found most suitable for tomatoes grown in pots in which the larger part of the soil was composed of sifted coal ashes. Training to a single stem gave the best results in these experiments. Plats which received no nitrogenous fertilizers gave greatly decreased yields.

An investigation was made of the profitableness of growing the tomato crop in the forcing house. The average gross returns from each square foot of surface has been 65.5 cts. On this basis, the returns for a crop of tomatoes in a house 20 by 100 ft. are estimated at $943.20 and the expense of growing the crop at $278.50, thus leaving a net profit of $664.70 from a little less than $\frac{1}{20}$ of an acre.

Orchard notes, F. S. EARLE (*Alabama College Sta. Bul. 106, pp. 163–176*).—These notes are largely confined to the effects of the unusual cold of February, 1899, on the apples, cherries, figs, grapes, Japanese persimmons, peaches, pears, and plums growing at the station and in different parts of the State. Notes on injurious insects and diseases are given in some instances.

> "On the morning of February 14, the thermometer was below zero in all parts of Alabama. At Auburn it registered —6.5° F., which was 10° lower than at any time in the 30 years during which records have been kept here. In north Alabama the temperature was several degrees lower, while at Mobile and at other points on the coast it was only some 4 or 5° warmer. Here naturally the destruction was greatest. Tender shrubs and trees of all kinds were killed to the ground, the long moss (Tillandsia) on the trees was killed to the ground, and the thickets of saw palmetto were scorched as if by fire. The live oaks and magnolias lost their leaves and even some of the pines were injured. Throughout the State the peach crop and, with a few exceptions, the plum crop was an entire failure."

Apple buds were not swollen at the time of the freeze and were entirely uninjured. The varieties Yellow Transparent for summer and Kinnard Choice for late fall and winter are recommended to be added to the provisional list of apples for Alabama already noted (E. S. R., 10, p. 1041).

Figs throughout the State were killed to the ground by the freeze. Celestial, White Ischia, Brown Turkey, Brunswick, and White Smyrna are considered the best varieties for planting in Alabama. None of the varieties of bunch grapes at the station suffered injury from freezing, but many of the Rotundifolia varieties were seriously frozen, Scuppernong being killed to the ground. Memory was entirely uninjured. Japanese persimmons were killed but sprouted from the crown in some instances. As a result of the freeze, only Persian and North China types of peaches are recommended for central Alabama. The older Keiffer and Le Conte pear trees were uninjured by the cold, though the swollen flower buds were killed. Many younger trees were killed outright. Bartlett and other varieties of European types of pears were dormant at the time of the freeze and escaped uninjured. The injury to plum blossoms was in almost exact proportion to the state of advancement. Only the following varieties bore full crops: Milton, Whitaker, Wooten, Wayland, and Golden Beauty. The Wayland group of plums are recommended for general planting.

In experiments to combat the green aphis of the apple, the most effective remedy was found to be a 25 per cent emulsion made by dissolving ¼ lb. of whale oil soap in 1 qt. of boiling water, emulsifying with 2 qt. of kerosene, and afterwards diluting to 2 gal. The author recommends that this emulsion be applied in a fine mist and only during the middle of bright warm days when the kerosene will evaporate quickly. Injudicious use of this spray or too frequent applications may result in considerable injury to the trees.

As a means of combating apple-leaf rust the author advises the planting of resistant varieties.

Some experiments were made in combating San José scale by the aid of the fungus *Sphærostilbe coccophila* with inconclusive results. Experiments were also made in spraying trees infested with San José scale with 35 and 50 per cent mixtures of kerosene oil. In some instances full strength solutions were used. The results were quite satisfactory except in a few instances where full strength solutions killed the trees. Thirty-five per cent solutions are recommended for combating the scale on apples and 25 per cent solutions on peaches and plums.

Ash analysis of twigs and leaves from apple trees, P. SCHWEITZER (*Missouri Sta. Rpt. 1898, pp. 77–81*).—"It was thought that the percentage composition of the ash of bearing twigs of fruit trees would show decided differences from that of so-called water sprouts. To determine the matter, small twigs of 2 seasons' growth from various trees were taken in the spring of the year, when the bearing twigs were covered with fruit buds, more or less opened, and possessing but few and only partially developed leaves, while the nonbearing shoots were straight, thin, and covered wholly with leaf buds or partly opened leaves. The twigs in either case were 8 to 10 in. in length and perhaps ¼ in. thick at the base. In a similar way both kinds of twigs were taken in the fall of the year from a tree which had not borne any fruit that season, and again next spring, when the 2 kinds of twigs differed more markedly in appearance than in the autumn preceding." The following table shows the percentage ash composition of the dry matter of the twigs:

Analyses of apple-tree twigs.

	Calcium oxid.	Potassium oxid.	Phosphoric acid.	Silica.	Magnesium oxid.	Sodium oxid.	Ferric oxid.	Sum.
	Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct*	*Per ct.*	*Per ct*	*Per ct.*
Water sprouts (Fameuse)	1.0290	0.7140	0.3552	0 2156	0.0966	0.0532	0.0070	2.4706
Water sprouts (Bellflower)	1.2717	.7549	.2997	.3613	.1239	.1490	.0316	2.9921
Water sprouts (Jennetin) fertilized with wood ashes	.6132	1.2782	.2198	.2450	.0591	.0896	.0217	2.5266
Average	.9713	.9157	.2916	.2740	.9932	.0973	.0201	2.6631
Fruit twigs (Fameuse)	2.1417	1.0455	.5410	.2538	.1207	.0730	.0124	4.8831
Fruit twigs (Bellflower)	2.3262	1.0935	.5432	.4395	.1509	.0754	.0262	4.6550
Fruit twigs (Jennetin) fertilized with wood ashes	2.3912	.7228	.3111	.6222	.1080	.1241	.0256	4.3023
Average	2.2864	.9539	.4651	.4385	.1265	.0908	.0231	4.3818
Twigs with fruit set (Jennetin) fertilized with wood ashes	2.0702	1.0364	.3819	.2645	.1288	.0399	.0228	3.9946
Twigs that had died of blight from same tree	2.3830	1.0925	.4428	.2866	.2054	.1870	.0332	4.4397

"It will be seen that while the percentages of the different components in the ash do not show striking differences for the two groups, excepting in lime and potash, yet, when calculated for dry matter in twigs, the results are obviously pregnant with meaning. Surely the much larger absolute amount of lime, phosphoric acid, and potash in the bearing twigs must be either the cause or the condition of their bearing. . . .

"The legitimate deduction from the foregoing facts would seem to be that the effect of fertilizing fruit trees can not possibly manifest itself the same year in an increased fruit crop, but appears of a certainty the year after, and that fruit growers, in valuing fertilizers, must bear this in mind to arrive at correct conclusions."

Analyses of ashes from apple peelings and leaves from trees fertilized and not fertilized with iron sulphate, P. SCHWEITZER (*Missouri Sta. Rpt. 1898, pp. 82, 83*).—The leaves and peelings taken for analysis in this experiment were obtained from Ben Davis trees, some fertilized and others not fertilized with iron sulphate. The fruits of the fertilized and not fertilized trees showed marked differences in appearance, the greater depth of color being in favor of the apples from the trees fertilized with the iron sulphate. The fruit was harvested at the usual time and the peelings and leaves carefully dried without being permitted to come in contact with any iron or steel instrument. The following table shows the results of the analyses of 100 gm. of water-free substance in each instance:

Analyses of ashes of apple peelings and leaves.

	Fine ash.	Silica.		Iron.	
	Grams.	Grams	Per cent.	Gram.	Per cent.
Fertilized with iron sulphate:					
Peelings	....	1.769	4.70	0.0131	0.74
Leaves	....	10.490	6.06	.0597	.57
Not fertilized with iron sulphate:					
Peelings	1.984	.220	11.09	.035	1.77
Leaves	12.641	.431	3.41	.075	.59

"The result as regards the quantity of iron is the reverse of what was expected, and if affirmed by subsequent trials can not be the direct cause of influencing the color of fruit. Indirectly, by perhaps stimulating the development of certain definite constituents, it might exercise an effect, as was plainly discernible in this trial."

Effect of spring frosts on the peach crop, with cultural notes on the peach in New Mexico, F. GARCIA (*New Mexico Sta. Bul. 30, pp. 215-251*).—The author states that the most serious drawback to the successful culture of the peach in New Mexico is the late spring frosts, which are certain to occur after the trees have started to bloom and which often destroy the whole crop. A very large percentage of the blooms and fruit buds are killed every spring by the frosts. In order to determine the more resistant sorts and the varieties best suited for culture in New Mexico, a careful record extending over 4 seasons was kept of the date of blooming, fruiting habits, and ripening period of 147 different varieties of peaches growing in the station orchard. The daily temperature of the winter and spring months for each season (1895-1898) was kept and a study made of the effect of frosts on the different varieties of peaches after they come into blossom.

The different varieties have been arranged in groups, according to the fruiting habits of each. Twenty-two of the varieties grown ripened their fruit in June and July, 38 in August, 16 in September, and 3 in October and November. Eleven varieties have fruited 2 seasons during the whole test, and 57 sorts have not fruited at all. Usually observations have been made upon 4 trees of each variety, although in some instances only 1 tree was available. Tables showing date of bloom, number of days of frost, minimum temperature after bloom, and date of ripening during the different seasons are given for each group, and the data commented upon at length.

The bulletin is summarized in part as follows:

"No variety that has been tested in the college orchard blooms late enough to escape all the freezing weather, although many kinds usually escape the most severe frosts.

"The date of full bloom in the several varieties of the peach varies from year to year, depending on the character of the season.

"The early peaches as a rule bloom later than the late varieties, thus escaping many days of varied freezing weather, and insuring a crop unless killed by severe frosts occurring some time after the fruit is set.

"Belated buds, being comparatively undeveloped when the main crop of flowers are open, frequently escape frosts that kill the full blossoms, thus setting at least a partial crop.

"Many varieties, especially the early kinds like Alexander, that fail in other States because of fungus diseases, do well in New Mexico, and some of them are leading commercial sorts."

The varieties which have best withstood frosts during the whole period and which are recommended as suitable for commercial orchards are Alexander, Arkansas Traveler, Waterloo, Gov. Garland, S. G. French, Boyle Early, Hyne Surprise, Family Favorite, and Muir. These same varieties are recommended for home use, and in addition George IV, Sargent, Early Silver, Hoover Heath. The varieties which have failed 1 or 2 years at the station, but on the whole have proved profitable, are Early Crawford, June Rose, Cother, Sallie Worrell, Hill Chili, Piquett Late, Chinese Cling, and Bequett Free. All but the last 2 of these are suitable for planting in commercial orchards.

Relative to the culture of peaches in New Mexico, it may be noted that irrigation is necessary for this industry. The selection of sites for peach trees, choice of soil, methods of irrigation for peaches, pruning and thinning commercial peach orchards, and the insects and diseases affecting peaches are briefly discussed.

The bulletin contains brief introductory remarks on peach culture in New Mexico by C. A. Keffer.

Fourth report on Japanese plums, L. H. BAILEY (*New York Cornell Sta. Bul. 175, pp. 123–151, figs. 18*).—This is a continuation of work already reported (E. S. R., 9, p. 1053). Notes are given on varieties of Japanese plums as taken on the station grounds during the season of 1899. The varieties recommended as most valuable for general uses and conditions and worthy of general planting are Engre, Lutts, Red June, Abundance, Burbank, Chabot, and Satsuma, enumerated in the order in which they ripened at Ithaca in 1899. Other varieties of secondary value, or those which must be further tested before they can be confidently recommended, are Berger, Kerr, Ogon, Georgeson, Hunn, Hale, and Wickson, named also in the order in which they ripened at Ithaca in 1899.

As a result of his observations for a series of years, the author believes that many of the great differences in opinion respecting the merits of individual varieties and the wide discrepancy in descriptions of them that are frequently made are due to the fact that the same tree may bear unlike fruit in different years.

Prunes, J. A. BALMER (*Washington Sta. Bul. 38, pp. 1–36, figs. 11*).—This bulletin is designed to supply information as to the best methods of preparing prunes for market. Cultural methods in most common use locally are briefly discussed, notes are given on the Italian, French, and Silver varieties of prunes, the merits of each are presented, and the details of preparing the fruit for market are set forth with considerable fullness. The processes treated of are evaporation, grading, dipping, packing, and sweating, the paragraphs on evaporation and grading especially including accounts of a number of methods and kinds of apparatus in use. A number of the pieces of apparatus are figured.

It is stated that prunes have a relatively high feeding value for hogs. Fed alone, they do not form a well-balanced ration, but with a little barley or pea meal added, it is said, hogs will grow and fatten well.

Strawberries, S. M. EMERY (*Montana Sta. Bul. 20, pp. 104–109, chart 1*).—Variety tests and experiments in pollination of strawberries are reported. An experiment was made with Crescent seedling strawberry plants, the object of which was to determine the distance at which pistillate and staminate plants should be set to secure the best results in pollination. The arrangement of varieties and the yield of each plant in the experiment are shown in a chart. Not a single uncovered plant failed to mature some fruit, although some of them were from 20 to 27½ feet distant from any staminate plants. At the same time a second experiment was made with a part of the plants just referred to, the object of which was to determine the extent of the agency of insects in pollenizing strawberry blossoms. A part of the plants were covered with cheese-cloth netting, the meshes of which were $\frac{1}{16}$ of an inch in diameter. Those plants which remained covered throughout the experiment failed to produce a single good berry although there were a few very imperfect ones. It was observed in the course of this experiment that much the largest yield of fruit was obtained from those plants immediately adjacent to those covered with the cheese cloth. "It was as if pollen-laden insects had been attracted by the white covering of cheese cloth and had traveled over it to sides or ends, and failing to get entrance to the protected blooms underneath had moved to the plants the nearest thereto."

The chemical composition of certain small fruits, A. D. SELBY (*Ohio State Hort. Soc. Rpt. 1898, pp. 150–154*).—The author has made determinations of the percentages of water, solid material (both soluble and insoluble), seeds, acid, sugar, pectins, fiber, and ash of 11 varieties of strawberries, 7 of raspberries (1 black, 1 purple, and 5 red varieties), 4 of currants, 2 of blackberries, and 3 each of gooseberries and cherries. Fruit of the different sorts was gathered and analyzed on different dates during the ripening period of each. The data for each variety are tabulated. The following table summarizes the analyses:

Average analyses of small fruits and cherries.

	Water.	Seeds.	Crude fiber.	Protein.	Ash of seeds.	Ash, excluding seeds	Soluble solids.	Free acids.	Reducing sugars.	Pectins.	Ratio of acids to sugar.
	Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
Strawberries	92.55	0.93	0.31	0.61	0.03	......	4.48	1.01	3.03	0.62	0.23
Black raspberries	80.86	6.26	.21	1.50	.09	0.55	9.83	1.20	6.44	.97	.19
Red raspberries	83.59	2.20	.23	1.20	.05	.45	1.45	1.62	8.20	1.40	.20
Blackberries	85.53	3.56	.38	1.26	.10	.29	8.87	0.91	7.57	......	.13
Red currants	85.55	1.58	.41	1.21	.03	.57	10.31	2.73	6.82	1.17	.40
Gooseberries	86.44	1.41	.43	.74	.05	.28	12.23	1.61	4.06	.45	.40
Sour cherries	81.72	5.22	......	1.43	......	......	10.74	1.47	7.38	1.09	.20

"These samples were chiefly taken in good, fair weather. . . . Much less acid and sugar and, therefore, less water-soluble solids and nutritive matter would be found after rainy weather and scant sunshine."

Report of the horticulturist, L. R. TAFT (*Michigan Sta. Rpt. 1898, pp. 126–133*).—This is a brief summary of the work of the department during the year, showing the different lines of experiments undertaken and the progress made. Crimson clover used as a cover crop in orchards has given the best results when seeded July 1. Oats have proven well adapted for use as an orchard cover crop on heavy clay soils. The results in successful spraying experiments against the peach leaf-curl are reported and are noted elsewhere in this issue (p. 1059). Wood ashes have given good results on lawns when applied at the rate of 50 bushels per acre. The effect of wood ashes and ground bones combined was prominently visible on lawns throughout the whole season.

Report of the horticulturist, J. F. C. DU PRE (*South Carolina Sta. Rpt. 1898, pp. 22–36*).—Brief notes on the asparagus, beans, Lima beans, beets, table beets, stock beets, sugar beets, Brussels sprouts, carrots. cabbages, cauliflower, celery, cucumbers, eggplants, cantaloupes, lettuce, watermelons, onions, potatoes, English peas, strawberries, apples, pears, peaches, plums, Japanese persimmons, and other fruits and nuts grown at the station during the season. Data and descriptive notes as to yields and best varieties are given in some instances, and mention made of the more prevalent insects and diseases of fruits.

Asparagus culture in the South, W. F. MASSEY (*Florida Agr., 27 (1900), No. 19, pp. 202, 203*).—The profitability of this crop is discussed and detailed directions given for its culture and fertilization.

Bur, or Globe, artichokes, W. T. SWINGLE and D. G. FAIRCHILD (*U. S. Dept. Agr., Division of Botany Circ. 22, pp. 6, fig. 1*).—A brief description of the artichoke, *Cynara scolymus*, with notes on methods of culture in Europe and in Louisiana. Methods of cooking are suggested.

Manuring field cucurbits, H. KOCH (*Deut. Landw. Presse, 27 (1900), Nos. 22, p. 253; 24, p. 278*).

Yams in the West Indies, D. G. FAIRCHILD (*U. S. Dept. Agr., Division of Botany Circ. 21, pp. 4, fig. 1*).—The varieties of yams (*Dioscorea* spp.) in Jamaica and Barbados and methods of yam culture observed in these places are given, with some suggestions as to their adaptability to the subtropical agriculture of the United States.

Horse-radish culture in Bohemia, D. G. FAIRCHILD (*U. S. Dept. Agr., Division of Botany Circ. 20, pp. 3, figs. 2*).—Brief descriptive and cultural notes on a variety of horse-radish known in Germany and Austria as "Malner" or "Maliner Kren" which has been imported for distribution.

Some Chinese vegetables (*Sci. Amer., 83 (1900), No. 14, p. 211*).—A description of some of the vegetables sold in the Chinese quarters of San Francisco (E. S. R., 11, p. 777).

Distribution of seeds and plants, E. J. WICKSON (*California Sta. Seed Bul., 1899–1900, pp. 4*).—A list is given of the plants and seeds available for distribution through the station for the coming season. The usual condition of a small payment for seeds is retained, and the limited quantity of many varieties is mentioned in order to insure early application. The plants offered this season are new varieties of European strawberries; trees and shrubs, mostly exotic; resistant grapevines; plants for green manuring; forage plants; cereals; and promising varieties of garden plants.

Edible fungi, A. NYS (*Belg. Hort. et Agr., 12 (1900), No. 4, pp. 51, 52*).—A popular article on mushroom culture, uses, etc.

Plant breeding by bud selection, A. S. HITCHCOCK (*Amer. Gard., 21 (1900), No. 266, p. 59*).

Stringfellow method of planting an orchard, H. M. STRINGFELLOW (*Nat. Nurseryman, 8 (1900), No. 3, p. 25*).—The author describes his method for setting peach, pear, and apple trees in sod.

Fruit-tree pruning—No. 9, G. QUINN (*Jour. Agr. and Ind., South Australia, 3 (1900), No. 7, pp. 589–603, figs. 17*).—The principles of pruning evergreen fruits are discussed and detailed, illustrated directions given for the culture and pruning of lemons, oranges, and loquats.

Fruit growing under irrigation, W. J. ALLEN (*Agr. Gaz. New South Wales, [illegible] (1899), No. 12, pp. 1268-1274, pls. 3*).—Popular articles largely taken from California sources.

Grafting oranges on Bitter Seville stocks (*Agr. Jour. Cape Good Hope, 16 (1900), No. 5, pp. 305-310*).—Suggestions regarding the use of Bitter Seville as stocks. Its use is especially recommended as a resistant stock against root rot.

Orchard trees, S. M. EMERY (*Montana Sta. Bul. 20, pp. 98-104*).—Observations are reported on the hardiness at the station of a large number of varieties of orchard fruits set in 1895, and a list of the apples, crab apples, pears, cherries, plums, and prunes that have thus far proved hardy is given. Brief popular notes are given on the leaf blight of apples, which, it is stated, has not as yet been observed in Montana.

The effects of alfalfa and grass on the growth of young orchard trees (*Hessische Landw. Ztschr., 70 (1900), No. 7, pp. 78, 79, fig. 1*).—Alfalfa seriously retarded the growth of young apple trees as compared with trees grown on land in cultivated crops and wheat.

Classification of the peach (*Amer. Gard., 21 (1900), No. 269, pp. 116, 117*).—Extracts from an article delivered by R. H. Price before the Natural History Society of the Agricultural and Mechanical College of Texas.

Propagation of native plums, F. CRANEFIELD (*Rural New Yorker, 59 (1900), No. 2612, p. 103*).—Crown grafting year-old trees, top grafting older trees, and intensive and thicket culture of native plums are discussed.

Persimmons, M. L. HENRY (*Jour. Soc. Nat. Hort. France, 4 (1900), No. 1, pp. 132-138, fig. 1*).—Cultural directions, with notes, on the flowering habits and methods of pruning Japanese persimmons (*Diospyros kaki*).

Instructions in the culture and uses of cacao, G. D'UTRA (*Bol. Inst. Agron. São Paulo, 10 (1899), No. 9-10, pp. 539-581*).—A description of the methods of culture and manufacture in Brazil, with an analysis of the seeds.

Coffee culture in Queensland—No. 2, H. NEWPORT (*Queensland Agr. Jour., 6 (1900), No. 2, pp. 120-125, figs. 2*).—Details are given regarding the nursery management of coffee trees.

Tea, its culture and manufacture, V. BOUTILLY (*Le thé, sa culture et sa manipulation. Paris: G. Carré and C. Naud, 1898, pp. 108, figs. 18*).—The origin, botany, and production of tea are considered, together with methods of culture and manufacture followed in Ceylon and the adaptation of those methods in the French colonies.

The manuring of tea (*Planting Opinion, 5 (1900), No. 14, pp. 237, 238*).—Results obtained in manuring tea with 9 different combinations of commercial fertilizers are reported and an analysis given of the soil on which the tea grew. No conclusions are drawn from the tests.

Vanilla and other cultures in Réunion, C. W. BENNETT (*Bul. Bot. Dept. Jamaica, n. ser., 7 (1900), No. 1, pp. 8-14*).—Special attention is given in this article to the drying of vanilla by the use of chlorid of calcium.

Culture of vanilla in Mexico, H. LEMCKE (*Tropenpflanzer, 4 (1900), No. 3, pp 130-139*).

Vanilla (*Garden, 57 (1900), No. 1469, p. 35, fig. 1*).—Methods of greenhouse culture are given. The author states that from his experience it is not a profitable plant to grow under glass.

Nutmeg growing in its native home (*Jour. Jamaica Agr. Soc., 4 (1900), No. 4, pp. 208-210*).—Gives methods of growing and curing the nutmeg in the Dutch East Indies.

Studies on the hop, F. CHODOUNSKY (*České Listy Hospodářské, 8 (1900), No. 1, pp. 8-15, figs. 7*).

Currants for market and the home garden, T. J. DWYER (*Amer. Gard., 21 (1900), No. 274, pp. 203, 204*).—General cultural directions with descriptions of 5 desirable market varieties and 2 varieties for the home garden.

Pot-grown strawberries for the home garden, T. J. DWYER (*Amer. Gard., 21 (1900), No. 275, pp. 221, 222*).—Suggestions regarding the growing of strawberries in pots for transplanting in the home garden with descriptive notes on 6 varieties well suited for this purpose.

Influence of different cuttings on the quality of wines, G. HERON (*Prog. Agr. et Vit., 16 (1899), No. 37, pp. 314-320*).

Experience with the English walnut, N. POMEROY (*Amer. Gard., 21 (1900), No. 275, p. 223, fig. 1*).—The author reports growing these nuts in Niagara County, New York. The trees have withstood a temperature of —18° F.

Root grafting the walnut (*Pacific Rural Press, 59 (1900), No. 12, p. 177, figs. 3*).

Grafting the walnut (*Pacific Rural Press, 59 (1900), No. 11, p. 161, figs. 5*).—A description of methods of grafting the English and the black walnut.

India rubber cultivation (*Planting Opinion, 5 (1900), No. 4, pp. 64, 65*).—This article discusses the culture and production of rubber from different species of rubber trees and states that "experiments are now being carried on in London and Trinidad to secure rubber from year-old plants of the *Castilloa elastica*. . . . It has been found that seeds sown broadcast over a prepared field will yield an abundant crop of young trees which at about one year old can be cut and sent to a factory where, with ordinary machinery, 8 per cent of fine rubber can be extracted from the young shoots. . . . This young tree crop, at present prices, would return an estimated profit of $200 to $400 per acre."

Rubber trees and their culture, H. LECOMTE (*Les arbres a gutta-percha leur culture. Paris: G. Carré and C. Naud, 1899, pp. 95, figs. 7, map 1*).—This work treats of the species of plants producing rubber, of the collection and manipulation of sap, production and commerce in rubber, and of the acclimatization of plants in the Antilles and Guiana.

Culture of rubber, G. D'UTRA (*Bol. Inst. Agron São Paulo, 10 (1899), No. 8, pp. 514-536*).—A description is given of species and varieties of plants producing rubber, with notes on the establishment and management of a rubber grove and on the collection and handling of the sap. A list of the substances found to be useful in coagulating the milk of sap is included.

India rubber in South America (*Sci. Amer., 82 (1900), No. 8, p. 122*).—Abstract of report to the French Government by M. Poisson.

The tapping of the rubber tree, E. HENRICI (*Tropenpflanzer, 4 (1900), No. 2, pp. 79, 80*).—Results of trials of tapping relative to flow of sap and effect on tree.

A gutta-percha plant susceptible of being cultivated in temperate climate, DYBOWSKI and G. FRON (*Compt. Rend. Acad. Sci. Paris, 129 (1899), No. 15, pp. 158-160*).—An account is given of the successful cultivation in Europe of *Eucomia ulmoides*, a plant belonging to the Euphorbiaceæ. The plant is described at some length, and the method of separating the gutta-percha and the amount obtained. The plant originally comes from the north of China, and it is thought that its cultivation can be successfully carried on in regions possessing similar climatic conditions.

American-grown bulbs (*Florists' Exchange, 12 (1900), No. 18, p. 476*).—Comments by Andreas Simon, of Chicago, on growing bulbs, especially in the Puget Sound region.

Sweet peas in Canada, S. P. (*Amer. Florist, 15 (1900), No. 617, pp. 1041-1043*).—Light clay loam is considered the best soil for sweet peas. On poor soil, sandy soil, or heavy clay, the trench system of culture is recommended. Descriptive notes are given on the growth of 35 varieties.

Flower farms of California, S. M. HALL (*Land of Sunshine, 12 (1900), No. 5, pp. 280-290, figs. 9*).

The flower gardens of Japan, F. W. BURBRIDGE (*Garden, 57 (1900), No. 1484, pp. 304-306, figs. 2*).

FORESTRY.

Report upon the forestry investigations of the U. S. Department of Agriculture, 1877-1898, B. E. FERNOW (*U. S. House Representatives, 55. Cong., 3. Sess., Doc. 181, pp. 401, figs. 105, pls. 32*).—This is a special report "upon the forestry investigations and work of the Department of Agriculture, showing the results obtained and the practical utility of the investigations," prepared in accordance with a provision in the act of Congress making appropriations for the Department of Agriculture for the fiscal year ended June 30, 1899. The author treats the subject in 3 parts: (1) A brief historical sketch of the administrative features of the Division of Forestry, with the reasons for its establishment; (2) the work done by the division, and (3) a résumé of the status of the forestry movement in the United States and the relation which the Division has had to it.

The principal part of the report is contained in an appendix on "Forests and Forestry in the United States," in which is comprised a summary account of forestry conditions in the country, geographic distribution and classification of forests, and a list of 100 trees of the United States important in forestry; biological studies on the Southern pines (E. S. R., 8, p. 602); a description of the various kinds of wood and their present application in the arts (E. S. R., 7, p. 774); a detailed study of the structure of the wood of 5 Southern pines (E. S. R., 8, p. 602); a discussion of the economic aspects of the forest resources of the United States; an illustration of forest conditions in the lumbering regions of the Northwest, based on a survey of the forestry conditions in Wisconsin and a study of the stages brought about in the course of exploitation (E. S. R., 10, p. 51); a detailed study of the naval-store industry in the United States, reprinted mostly from the Annual Report of the Division for 1892; notes on the origin and development of the forestry movement in the United States, including accounts of the forestry legislation in various States and a list of bills relative to forestry introduced into Congress; a discussion of the forest policies of European nations; a discussion of the forest conditions and methods of forest management in Germany, with a brief account of forest management in British India; text book presentations of the principles of sylviculture and of forest economy; forest influences (E. S. R., 5, p. 94); a summary account of the timber-physics work of the Division (E. S. R., 3, p. 729, and 5, p. 96); and a very brief summary of the results of the Division's investigations on metal ties for railways (E. S. R., 7, p. 164). In several cases the papers are reprints or abstracts of former publications of the Division of Forestry.

The thinning and pruning of forest areas, C. E. CURTIS (*Jour. Roy. Agr. Soc. England, 3. ser., 10 (1899), pt. 4, pp. 617-625, figs. 4*).—An account is given of the management of a young oak plantation in the north of Ireland. The plantation is a rather extensive one and is about

30 years old. The oaks were planted at 12 ft. distances, with larch, spruce, silver fir, and Scotch and Austrian pines as nurse trees. The larches were seriously attacked with canker and have all been removed. The other trees have made satisfactory growth. The present stand shows oaks at the rate of 300 to the acre, with about 200 nurse trees. The oak trees have been pruned twice, each time between the months of November and March. The branches did not exceed 3½ in. in diameter and were cut upward close to the trunk, leaving a smooth surface, which has healed readily. In this way clean trunks to 12 ft. have been secured, and it is intended to prune further until clean stems of over 20 ft. are secured, after which the natural pruning will be depended upon.

The thinning of the plantation has been gradual, small thinnings being made now and then, and has been found most beneficial.

Lightning and its effect on trees, F. J. Brodie (*Jour. Roy. Agr. Soc. England, 3. ser., 10 (1899), pt. 4, pp. 608–617, figs. 2*).—On account of the recent damage to beech trees at a number of places, an investigation was made on the effect of lightning on trees. It is stated that the greater number of the injured trees presented the appearance of dead tracts of bark and wood from 8 to 12 in. wide, running a long way down the stem of the tree. The bark had begun to crack and fall off, exposing the hard, dead wood below, which was cracked with numerous shallow fissures. Along the edges of the injured tracts the uninjured bark and stem were developing a healthy and vigorous callus, which was gradually repairing the injury.

Original and compiled notes are given on the liability of different varieties of trees to lightning, considerable quotations being made from a report of the Weather Bureau of this Department (E. S. R., 8, p. 34; 11, p. 322).

Forest department, S. M. Emery (*Montana Sta. Bul. 20, pp. 96–98*).—A report is made upon a test of a number of species of forest trees, begun at the station in 1895. The species which have thus far done best are white birch, cottonwood, bur oak, European larch, Scotch pine, Austrian pine, red cedar, and Colorado blue spruce. Brief economic notes are given on the narrow-leaf cottonwood (*Populus angustifolia*), and the broad-leaf cottonwood (*P. balsamifera*).

Shade trees, J. Fields (*Oklahoma Sta. Rpt. 1899, pp. 78–80, pl. 1*).—Notes are given on a number of shade trees which have been planted and are under investigation by the station. A report is given of the condition in June, 1899, of the forest trees grown on the station grounds in cooperation with the Division of Forestry of this Department. A summary is also given of the degree of hardiness of a number of the more prominent varieties.

Observations on the forests of eastern Pandoland, T. R. Rim (*Agr. Jour. Cape Good Hope, 16 (1900), Nos. 1, pp. 21–42; 2, pp. 104–115*).—Notes are given on the general characteristics of the forests of this region. The principal species are described and the distribution, economic characteristics, and common names are given. It appears from remarks concerning the vertical distribution of the species, that 2 species do not extend to the coast, 8 are confined to the coast region below 500 ft., while 23 range from the coast up to 1,000 ft., 46 to 2,000 ft., 25 to 3,000 ft., 28 to 4,000 ft., 42 to 5,000 ft., and 16 to 6,000 ft. altitude.

State forestry (*Gard. Chron., 3. ser., 26 (1899), No. 675, p. 418*).—A review is given of a paper read by D. E. Hutchins, conservator of forests, Cape Town.

Some timber trees of Queensland, I. W. Fawcett (*Queensland Agr. Jour., 6 (1900), No. 1, pp. 47–49*).—Notes are given on the timber value of *Tristania conferta*, *T. laurina*, and *Backhousia citriodora*. Botanical descriptions, vernacular names, and notes on distribution are also given.

Tree planting in South Australia, A. F. Noll (*Queensland Agr. Jour., 6 (1900), No. 1, pp. 49, 50*).—An extract is given of a paper on this subject in which experiments in tree planting are described. The sugar gum (*Eucalyptus corynocalyx*), is said to be one of the most valuable trees for planting in arid regions.

Useful Australian plants, J. H. Maiden (*Agr. Gaz. New South Wales, 11 (1900), No. 1, pp. 19–22, pls. 2*).—Notes are given on the botanical characteristics, timber quantity, insect enemies, and distribution of the forest red gum (*Eucalyptus tereticornis*) and the yellow box (*E. melliodora*).

The eucalyptus in the Tropics, J. Gifford (*Forester, 6 (1900), No. 1, pp. 11–13, fig. 1*).—A popular account is given of the rapid growth and value as a sanitary agent of eucalyptus trees.

Notes on the sal coppice forests of Oudh, S. Eardley-Wilmot (*Indian Forester, 25 (1899), No. 7, App. pp. 21*).

Notes on improvement fellings in sal forests, S. Eardley-Wilmot (*Indian Forester, 25 (1899), No. 7, App. pp. 17*).

The treatment of some resinous forests in France (*Indian Forester, 25 (1899), No. 11, pp. 1–44*).—Notes on the management of a number of forests in different parts of France.

The decay of forest and shade trees, A. C. Forbes (*Gard. Chron., 3. ser., 26 (1899), No. 669, p. 308*).—Notes the causes of many decays of trees and suggests possible prevention.

The influence of forests upon storage reservoirs, J. D. Schuyler (*Forester, 5 (1899), No. 12, pp. 285–288*).—The author reviews some of the forestry conditions in Europe, and states some of the conditions essential to the maintenance of stream flow and water conservation.

Recent investigations on the effect of lightning on trees, R. Hartig (*Centbl. Gesam. Forstw., 25 (1899), No. 12, pp. 523–544, figs. 29*).

The Haskin process of vulcanizing timber, J. Nisbet (*Indian Forester, 25 (1899), No. 10, App. pp. 1–10, figs. 6*).—Notes are given on antiseptic treatment for the protection of railway and other timber against decay.

Injection of wood (*Sci. Amer., 82 (1900), No. 4, p. 51*).—A method of injection of copper salts in railroad ties for their preservation is described.

The forestry schools of Europe, S. W. Fletcher (*Amer. Gard., 21 (1900), No. 275, pp. 219, 220*).—Notes on the schools of forestry in Germany, Belgium, Denmark, France, Holland, and other European countries.

SEEDS—WEEDS.

Alkali studies—III, B. C. Buffum (*Wyoming Sta. Rpt. 1899, pp. 40*).—This report contains a detailed statement of the experiments described in a previous bulletin (E. S. R., 10, p. 1025). It deals principally with the effect of alkali on the germination of seed.

The author's summary is as follows:

"(1) The presence of very small amounts of sodium sulphate, sodium chlorid, magnesium sulphate, or sodium carbonate undoubtedly has a beneficial effect on the germination of seeds and growth of plants. Large amounts of the same salts retard germination.

"(2) Of the salts most abundant in the alkali of the arid regions those that have the greatest detrimental effects on germination, in order, are sodium carbonate, sodium chlorid, sodium sulphate, and magnesium sulphate.

"(3) The retarding effect of a salt solution on the germination of seeds is in direct proportion to its osmotic pressure, except where other factors enter in, such as the caustic effect of sodium carbonate, or where solutions are very dilute."

Alkali studies—IV, E. E. SLOSSON (*Wyoming Sta. Rpt. 1899, pp. 29*).—A detailed account is given of experiments to determine the rate and amount of water imbibed by seeds from various salt solutions, comparisons being made with the rate at which distilled water is imbibed. The investigations were conducted with wheat, sunflower, peas, buckwheat, rape, and scirpus. In order to show that the rate of imbibition is not affected by the vitality of seed, similar experiments were conducted with seeds that had been killed by vapors of formalin, with old seed, and bits of wood. The author's summary of his results is as follows:

"Experiments on the imbibition of water by a large number of different kinds of seeds show that in all cases the presence of salts in solution hinders the absorption of water. Isosmotic solutions produce nearly the same effect, showing that the osmotic pressure is more important than the kind of salt. Retardation of imbibition does not increase proportionally with the osmotic pressure or with the concentration of the solution, but less rapidly. An osmotic pressure of five or ten atmospheres retards the imbibition of water to a considerable extent with all seeds, and in dilute solutions a difference of one atmosphere makes a perceptible difference in most cases. Salts are absorbed from solution by seeds, but not in the proportion in which they exist in the water. The accumulation of salt in the seed is gradual, so the osmotic pressure of the solution in the seed tends to approach that outside. That the imbibition of water is not due to the action of life is shown by the fact that similar results are obtained from living and dead seeds and dry wood. Dilute solutions of the common alkali salts do not poison the seed or prevent its germination when the conditions become more favorable. Different salts are absorbed from solutions in proportion to their diffusibility. The percentage of water imbibed by seeds in distilled water before their germination is as follows: Corn 106, sunflower 137, peas 120, buckwheat 65, rape 57, scirpus 33, and wheat 62. The germination of seeds in various salt solutions gives results similar to those on the imbibition of water. Wyoming alkali consists principally of sodium sulphate, sodium chlorid, and magnesium sulphate in varying proportions, but in some parts of the State the magnesium sulphate is replaced by sodium carbonate."

The influence of the temperature of liquid hydrogen on the germinative power of seeds, W. THISELTON-DYER (*Proc. Roy. Soc.* [*London*], *65* (*1899*), *No. 420*, *pp. 361–368*).—In connection with Prof. Dewar the author conducted a series of experiments to test the effect of extremely low temperatures on the germination of seeds. Mustard, peas, vegetable marrow, musk, wheat, and barley were subjected to temperatures of —250 to —252° C. for an hour, care being taken that the seed should be cooled gradually to avoid injury by the sudden creation of a vacuum. The seeds were later sown in a cool greenhouse without heat, and in 4 days had germinated. The germinations were: Mustard 100 per cent, peas 100 per cent, vegetable marrow 96 per cent, wheat 96 per cent, barley 100 per cent. Musk, on account of the extreme smallness of the seed, was not counted, but the germination is reported as good. A few days later a mixed lot of seeds of the same kind, with the exception of the musk, was immersed in liquid hydrogen for more than 6 hours. In this case the drop in temperature was sudden, no attempt being made to prevent the formation of a vacuum. No injury was visible which could be traced to the severe cold through which the seeds had passed. They were sorted and immediately sown, with the result that 4 days later every seed had germinated. The author discusses at some length the physiological bearing of this experiment.

On the after ripening of the small grains, A. ATTERBERG (*K. Landt. Akad. Handl. Tidskr., 38 (1899), No. 4, pp. 227–250; Tidskr. Landtmán, 20, pp. 477–482*).—The author investigated the conditions under which imperfectly ripened seed of barley and rye may be brought to full ripeness, and the temperatures most favorable to the germination of such seed. It was found that in order to reach a complete and rapid germination of seed that had not been thoroughly ripened the germination temperature must be lowered from 20° C. (68° F.), now commonly used, to 15° C. (59° F.). All samples examined germinated rapidly and completely at the lower temperature. Rye and barley should germinate completely in 8 days at this temperature; wheat, and probably oats, in 10 days. Seed not germinated in this length of time are either dead or so immature that their value is uncertain.

Many different degrees of ripeness were observed to exist, characterized by different maximum temperature limits for complete germination. Some seeds will germinate completely at 15° C., but incompletely at 19°; others completely at 18, 22, and 27°, and incompletely at 22, 25, or 34°, respectively. The after ripening goes through numerous stages and is not complete until the maximum germination is reached at 30° C. (86° F.). Above this temperature a complete germination was not reached. The safest temperature for increasing the germination of seed grain and least dangerous for its germination was found to be 30 to 40° C.—F. W. WOLL.

The weed seeds of clover and grass seed, with special reference to their place of origin, O. BURCHARD (*Die Unkrautsamen der Klee- und Grassaaten mit besonderer Berücksichtigung ihrer Herkunft. Berlin: Paul Parey, 1900, pp. 100, pls. 5*).—In this book the author discusses the bearing of weed seed on the determination of the origin of commercial seeds, the distribution of various weed seed throughout the regions where clover and grass seed are produced, and studies of weed seed. Short descriptions are given of the weed seed which have been found by him in commercial samples of clover and grass seed, the size, general appearance, color, and external structure of the seed being described with considerable minuteness. In all 378 weed seeds are described. From a tabular arrangement of some of the more common, it appears that 94 species of weed seed characterized the clover and grass seed of middle, eastern, and southern Europe, while 33 are said to be characteristic of North American seed, and 7 of South American seed.

Keys are given for the generic determination of the seeds of Compositæ and Labiatæ found in grass and clover seed.

The weeds of alpine meadows and pastures, F. G. STEBLER (*Landw. Jahrb. Schweiz, 13 (1899), pp. 1–120, pls. 20, figs. 40*).—The author discusses the most important weeds of alpine meadows and pastures, giving data relating to their duration, growth, distribution, and amount of injury done. Suggestions are also given for the destruction of the injurious species, fertilizing, grazing, cutting, burning, pulling, digging out, and plowing the soil being the principal methods suggested.

In the second part of the report descriptions and specific directions for eradication are given for nearly 100 obnoxious meadow plants. These are divided into the woody species, 24 in number, and the herbaceous species, 68 in number.

The present status of the Russian thistle in Washington, C. V. PIPER (*Washington Sta. Bul. 37, pp. 14, map 1*).—This weed was first detected in the State in 1897 and a number of points of infection were located. Contributions were made by the county boards of a number of counties for its eradication, which included a thorough inspection of the railway lines of eastern Washington, and in most cases the destruction of patches of Russian thistles that were found. In 1898 further investigations were conducted and attempts made to eradicate the weed wherever found. With 3 exceptions, all the patches found were along railways.

It was demonstrated that the Russian thistle produces in eastern Washington two crops a year, the first becoming full grown in July and August, at which time the second crop consists of small plants an inch or two high. Where the larger plants were cut in July, it was found that in October the second crop was fully developed and the ground as completely occupied as before. To eradicate such patches, the plants must be cut in July or early August and again in September or October. At no point in the State has the Russian thistle become abundant enough to result in actual loss. It is thought probable that by careful inspection it may be kept in check.

A report of the seed-control stations of Göteborg and Bohus for the year ended June 30, 1899, J. E. ALÉN (*Goteborg, 1900, pp. 14*).—A report is given of the investigations conducted at the seed-control stations in determining the purity, vitality, etc., of a large number of kinds of seed. The results are tabulated and commented upon at some length.

Report of the seed-control station in Hohenheim, O. KIRCHNER (*Wurttemberg. Wchnbl. Landw., 1900, No. 7, pp. 90–95*).—Table showing percentage purity, germination, and worth of 1,442 samples of farm and garden seeds, with comments.

Testing seeds, C. O. TOWNSEND (*Maryland Agr. Col. Quart., 1899, No. 6, pp. 12, figs. 4*).—The author describes the objects and methods of seed testing, gives the conditions essential for germination, describes various kinds of apparatus used in testing, gives directions for selecting samples, table of germination standards, etc. Much of the information is compiled from Yearbooks of this Department.

Germination of seeds, A. H. WARD (*Amer. Gard., 21 (1900), No. 274, p. 209*).—The temperature and moisture conditions involved in the germination of a number of farm and garden seeds are discussed, and tables given showing the minimum, maximum, and optimum temperatures for the germination of wheat, barley, peas, corn, beans, and squashes, and for the water absorption of the air-dried seeds of mustard, millet, corn, wheat, buckwheat, barley, turnips, rye, oats, hemp, beans, peas, clover, beets, and white clover. Soaking seeds in pure water tends to dissolve out materials needed in the germination and growth of seeds. The author recommends soaking in a solution of some fertilizer salt which will add to, rather than detract from, the vigor of the seeds.

The increase in mineral matter during germination, G. André (*Compt. Rend. Acad. Sci. Paris, 129 (1899), No. 26, pp. 1262-1265*).—A large number of experiments with *Phaseolus multiflorus* are reported, in which plants were analyzed at short intervals from germination. They were found to lose in dry weight for a considerable period, while the total weight of the ash increased. In no case was the experiment conducted long enough to have the plant establish itself or exercise the chlorophyll functions for any length of time.

On the hygrometric condition of seeds, L. Maquenne (*Compt. Rend. Acad. Sci. Paris, 129 (1899), No 20, pp. 773-775*).—Notes are given on the action of seeds in which there is an attempt to equalize the amount of water contained by the seed and that existing in the surrounding air. In this respect the seeds act as inert bodies, but it is probable that this relation has some bearing upon the latent life of the seed, a topic which the author proposes to discuss at some future time.

Germination of carob seed and production of mannose by a soluble ferment, E. Bourquelot and H. Hérissey (*Compt. Rend. Acad. Sci. Paris, 129 (1899), No. 16, pp. 614-616*).—The authors describe the germination of the carob and claim that during the germination mannose and galactose are formed in the embryo by the action of soluble ferments existing in the seed.

Composition of endosperm of carob seed, E. Bourquelot and H. Hérissey (*Compt. Rend. Acad. Sci. Paris. 129 (1899), No. 7, pp. 391-393*).—The carbohydrates, which represent four-fifths of the endosperm of the seed, are said to be chiefly anhydrids of mannose and galactose.

The influence of moisture on germination, W. Kinzel (*Landw. Vers. Stat., 51 (1899), No. 4-5, pp. 351-356*).

The chemical and physiological effect of anæsthetics on the germination of seeds, M. Soave (*Staz. Sper. Agr. Ital., 32 (1899), No. 6, pp. 553-592*).—The effect of chloroform and sulphuric ether upon the germination and chemical composition of the seeds of the peanut, squash, rice, maize, peas, and beans is given.

The action of anæsthetics on the vitality of dry and moist seeds, H. Coupin *Compt. Rend. Acad. Sci. Paris, 129 (1899), No. 15, pp. 561, 562*).—Experiments with wheat and crimson-clover seed, in which dry and moist seeds were subjected to the action of chloroform and carbon bisulphid. The experiments were repeated with dry and moist seed of the white lupine, crimson clover, hairy vetch, buckwheat, wheat, barley, maize, and hemp, from which it appeared that the vitality of moist seeds is seriously affected by anæsthetics.

On the analysis of sugar-beet seed, A. Vivien and Sellier (*Bul. Assoc. Chim. Sucr. et Distill., 17 (1899), Nos. 2, pp. 117-133, figs. 5; 3, pp. 197-216, fig. 1; 4, pp. 281-307, fig. 1*).

The testing of sugar-beet seed, A. M. Julhiard (*Bul. Assoc. Chim. Sucr. et Distill., 17 (1899), No. 2, pp. 134-145*).

On the occurrence of histidin and lysin in germinating seeds, E. Schulze (*Ztschr. Physiol. Chem., 28 (1899), No. 5-6, pp. 465-470*).—These substances are said to be products of proteid metabolism in germinating seed.

Histidin and lysin as metabolic products in conifer seeds, E. Schulze and E. Winterstein (*Ztschr. Physiol. Chem., 28 (1899), No. 5-6, pp. 459-464*).

Color variation in seed of Trifolium, A. Preyer (*Inaug. Diss., Berlin, 1899; abs. in Bot. Centbl., 81 (1900), No 7, pp. 243-245.*)

Weeds, J. FIELDS (*Oklahoma Sta. Rpt. 1899, pp. 77, 78*).—Brief notes are given on methods for eradicating weeds, the recommendations given being those suggested in Bulletin 41 of the station (E. S. R., 11, p. 354).

The occurrence of a new species of cuscuta on alfalfa, E. SCHRIBAUX (*Jour. Soc. Agr. Brabant-Hainaut, 1899, pp. 716–718*).

Poisonous weeds in the Springsure District, J. F. BAILEY (*Queensland Agr. Jour., 6 (1900), No. 1, pp. 39–42, pls. 3*).—The following plants are either known or suspected of being poisonous to stock: *Macrozamia moorei, Asclepias curassavica, Datura leichhardtii, Carissa ovata, Lactuca scariola, Cassia sophera, Swainsonia galegifolia, Eremophila maculata, Myoporum acuminatum*, and *M. deserti.*

Chemistry and the struggle with noxious herbs, J. GRAFTIAU (*L'Ing. Agr. Gembloux, 10 (1900), No. 6, pp. 413–428*).

DISEASES OF PLANTS.

A report on plant diseases studied during the year 1898 at the experiment station for plant protection at Halle, M. HOLLRUNG (*Jahresber. Vers. Stat. Pflanzenschutz, Halle, 10 (1898), pp. 35–64, figs. 3*).—A report is made on insect, fungus, and nematode diseases of cereals, sugar beets, potatoes, garden vegetables, and fruit and shade trees.

Among the enemies of cereals the author mentions *Dorcadion lineatum, Anisoplia agricola, Bibio hortulanus, Tipula pratensis, Cephus pygmæus, Ophiobolus herpotrichus*, and *Erysiphe graminis.*

White grubs, nematode worms, plant lice, and species of Silpha are considered the most important enemies of the sugar beet. *Rhizoctoma violaceæ* is an important fungus disease of this crop.

Among potato diseases, the author gives notes on the potato rot, scab, and attacks of the larvæ of *Eumerus lunulatus.*

Among fruit insects, attention is given to *Anthonomus pomorum, Rhynchites betuleti, Gastropacha quercifolia, Lyonetia clerckella*, oyster-shell bark-louse, and woolly aphis. Brief notes are given on *Fusicladium dendriticum* and *Peronospora viticola.*

The station received a number of proprietary substances for experimental purposes during the year. Antiherbium was tried for destroying weeds. One kilogram of this substance was dissolved in 28 liters of water and sprayed upon 10 square meters of land, upon which the following weeds were growing along with the grass: Leontodon, *Lamium album*, Plantago, and *Polygonum convolvulus.* The leaves of the Plantago and Polygonum were slightly burned; otherwise the substance seemed to be ineffective. Verminol was tried in the destruction of insects. The substance proved to be unsatisfactory. In experiments with calcium carbid in combating phylloxera, this substance gave unsatisfactory results.

Investigations on the prevention of wheat smut in Bavaria during 1898, DOBENECK (*Vrtljschr. Bayer. Landw. Rathes, 4 (1899), No. 3, pp. 255–282*).—An account is given of investigations on wheat smut in Bavaria. A compilation is made from a large number of reports on the occurrence of smut in different regions and as to the susceptibility of different varieties to disease. The beneficial results of soaking seed in copper-sulphate solutions, after which the seed are placed in lime solutions, and the Jensen hot-water treatment are mentioned, although from the data given no experiments seem to have been made with the hot water. The value of clean seed is commented upon, and threshing machines are given as a means by which the disease is widely spread.

Leaf scorch of the sugar beet, cherry, cauliflower, and maple, F. C. STEWART (*New York State Sta. Bul. 162, pp. 165–178 pls. 6*).—In August, 1899, the attention of the author was called to fields of sugar beets which were reported to be blighting. The so-called blight was characterized by the dead-leaf margins of slightly affected plants. In more severe cases the young leaves at the center of the crown were black and dead, as were the blades of the leaves. In the majority of cases the roots appeared normal, but the plants most severely attacked often showed a brown discoloration. The discolored tissue showed no indication of rot, but was separated from the healthy tissue by an indefinite, somewhat irregular line. The discoloration of the root is a physiological effect due to the death of the foliage rather than any parasitic organism.

The only other disease with which the leaf scorch is likely to be confused is the leaf spot, although in advanced stages it might be mistaken for the scab. In general it may be distinguished from the scab by the light-brown discoloration of the sound tissue. Affected roots were analyzed for sugar content, and showed that it was very appreciably reduced. Concerning treatment, it is stated that proper irrigation would prove a sure preventive of this disease, but where irrigation can not be practiced, the farmer should avoid planting on a light sandy soil, and in dry weather should conserve the moisture by stirring the soil frequently and especially after every shower.

In September of 1899 attention was called to a scorching of cherry foliage, which it was feared might prove an infectious disease like the fire blight of the pear and apple. On trees of all ages more or less of the foliage was brown, crisp, and dead. An examination made in the orchard showed that of 715 trees but 2 were unaffected, and six-sevenths of all the trees showed 75 per cent or more of the foliage scorched. The principal variety in this orchard was Montmorency, and it seems more commonly affected than any, although the English Morello and some others have shown it to a considerable extent. From the experience of the owners of the orchard, it is thought that little harm will result from the scorching of the foliage, on account of its appearance late in the season, although the subject is to be investigated further.

In September the entomologist of the station reported cauliflower leaves with their margins blackened and shriveled, accompanied with the statement that the partly unfolded leaves of cauliflower on eastern Long Island were generally affected in this manner. The author visited the region and found the affected leaves were growing and appeared normal except their crisp brown or black margins. Large plants were more severely injured than small ones, and the worst affected field observed was one in which the plants were large and thrifty and had begun to form heads. As with the beet and cherry scald, the exact time of injury was unknown, but it probably occurred during the last days of August. During this time there was continuous fog, but without rain, and it is the author's opinion that the injury was due to the hot sun falling upon the young leaves, which were unusually tender on account of having grown in foggy weather. The amount of damage done by tip burn to cauliflower was small.

A brief account is given of leaf scorch of Norway and sugar maples, due to physiological causes, as above. It happens whenever the quantity of water transpired by the leaves is greater than that which the roots can supply, and this condition may be brought about in several ways. Ordinarily, no serious injury is done by the disease, although in recently transplanted trees the effects may prove disastrous.

Apple scab in the Potlatch, L. F. HENDERSON (*Idaho Sta. Bul. 20, pp. 79-96, pls. 3*).—In 1897 this disease was located in what is known as the Potlatch district in Idaho, one of the principal fruit regions of this State. It is briefly described together with remedial treatment, such as spraying with copper sulphate solution, Bordeaux mixture, and ammoniacal copper carbonate.

In 1899 experiments were conducted by the station officers in an orchard that was badly infested with the disease. Two sprayings of Bordeaux mixture, or one spraying of copper sulphate and one of Bordeaux mixture, were given the trees, and in addition to a great reduction in the amount of apple scab present, it was also found that not more than half as many wormy apples were found upon the sprayed trees as upon those which had not been sprayed. The cost of the 2 applications per tree was 10 cts.

Spraying, L. R. TAFT (*Michigan Sta. Rpt. 1898, pp. 129-131*).—An account is given of a series of experiments conducted on peach trees to prevent leaf curl. The materials tested were a solution of copper sulphate at the rate of 1 lb. in 15 gal. of water, Bordeaux mixture containing 4 lbs. of copper sulphate and 10 lbs. of lime to 40 gal. of water, and a whitewash with the same amount of lime as in the Bordeaux mixture. These materials were applied to 10 trees each in March, and frequent examination during the growing season showed that there was but little difference in the efficiency of the 3 preparations, but a marked difference when the sprayed trees were compared with the unsprayed trees.

In order to learn if spraying would be beneficial after the leaves had developed, part of the unsprayed trees were treated with the 3 preparations mentioned above. The conditions were very unfavorable for the spraying, but from the experiments as well as results obtained in previous years, it seems that the application of fungicides to peach trees any time after the leaves have fallen and before the first of April will prevent the attack of leaf curl. Where spraying was neglected until the buds had begun to open and the fruit had set, the results were not satisfactory, although little difference was noticed in the results secured from the different fungicides. Copper sulphate solution, on account of its easy preparation and application, is recommended for the earlier applications.

The prevention of leaf disease in coffee, J. CAMERON (*Rpt. Supt. Govt. Gardens, Mysore, 1899, pp. 23*).—After reviewing the physical conditions of the country, the usual practice of cultivation of coffee is described. The value of different manures and methods of application is stated, and some results obtained by crossing and hybridizing are described.

Among the coffee pests, the most destructive is *Hemileia vastatrix*. This fungus partially or wholly destroys the leaves and persistently follows the coffee wherever cultivated. A virulent attack on an experimental plat in the gardens was temporarily checked by burning every infected leaf and coating the ground with a thick layer of lime. Spraying with a copper sulphate solution has also held the disease in check.

A leaf rot due to *Pellicularia koleroga* is described which frequently causes serious injury. The burning of infected leaves, application of flowers of sulphur in the early stages, or Bordeaux mixture and similar fungicides are recommended.

The principal insect pest of the coffee is *Xylotrechus quadrupes*. The method of attack of this insect is described, and remedies suggested.

The author emphasizes the necessity for better cultivation and proper fertilization of the crop. In this way the plants are made more healthy and are able to withstand insect and fungus attacks to a greater degree. Hybridization of varieties is thought to offer promising results, and next to this the interchange and special selection of seed is recommended.

The most efficient form of combination of copper fungicide and soap mixtures, M. HOLLRUNG (*Landw. Jahrb., 28 (1899), No. 3-4, pp. 593-616*).—The author has investigated the effect of adding soap to a number of the more common fungicides, such as Bordeaux mixture, copper sulphate solution, ammoniacal copper carbonate, copper-soda mixture, Burgundy mixture, and copper carbonate solution. The effect of different kinds of soap on the mechanical condition of the fungicide is shown by the amount of precipitate formed when the mixture is allowed to stand for a short time.

Formulas are given for making Bordeaux mixture, copper carbonate mixture, copper sulphate and ammonia, and ammonium copper carbonate solution with hard, soft, resin, and petroleum soaps. The characteristics of such mixtures are described and their uses given.

The cereal rust problem, G. MASSEE (*Nat. Sci., 15 (1899), No. 93, pp. 337-346*).—Discusses Eriksson's mycoplasma theory.

Rust in wheat—a probable preventive, W. DEACON (*Queensland Agr. Jour., 5 (1899), No. 2, pp. 162–164*).

A supposed new potato disease (*Agr. Gas. [London], 50 (1899), No. 1339, p. 162*).

The ring scab of sugar beets, FRANK (*Bl. Zuckerrübenbau, 6 (1899), No. 23, pp. 353–356, fig. 1*).—This article has been previously noted (E. S. R., 11, p. 861).

White rot of turnip, M. C. POTTER (*Extr. Proc. Durham Phil. Soc., 1899, Nov., pp. 3*).—A bacterial disease is briefly described.

Injury by sun scorching of foliage, F. H. HALL and F. C. STEWART (*New York State Sta. Bul. 162, popular ed., pp. 6, pl. 1, figs. 2*).—A popular edition of Bulletin 162 (see p. 1058).

A new disease of the short-leaved pine, A. P. ANDERSON (*South Carolina Sta. Rpt. 1898, pp. 16, 17*).—A note stating that investigations have been begun on a new disease of the short-leaved pine which is similar to the European larch "canker," and which is very common in the upper part of the State.

Leaf cast of pines and its prevention, CIESLAR (*Centbl. Gesam. Forstw., 25 (1899), No. 11, pp. 506–509, figs. 2*).—Notes on *Hysterium pinastri* and methods for its control. Spraying with copper fungicides is recommended.

A leaf browning of larch, R. HARTIG (*Centbl. Gesam. Forstw., 25 (1899), No. 10, pp. 423–426, fig. 1*).—*Allescheria laricis*, n. sp., is described. It attacks the leaves of larch, causing them to turn brown and later fall from the tree.

A new parasite of Carpinus betulus, R. HARTIG (*Centbl. Gesam. Forstw., 25 (1899), No. 11, pp. 485, 486, fig. 1*).—Notes are given on a disease of this tree, the cause of which is said to be the fungus *Phoma sordida*.

A sclerotid disease of beech roots, H. VON SCHRENK (*Rpt. Missouri Bot. Gardens, 10 (1899), pp. 61–70, pls. 2; abs. in Bot. Centbl., 80 (1899), No. 7, p. 278*).—A disease of beech roots is described, the mycelium of which is probably one of the Hymenomycetes.

A disease of osiers, V. DUCOMET (*Jour. Agr. Prat., 1899, II, No. 44, pp. 625–627, figs. 4*).—A disease of willows is described in which the leaves are attacked by *Glœosporium salicis*. Collecting and burning the fallen leaves is recommended, and where the attack is especially severe recourse should be made to some of the well-known fungicides.

Nitrogen hunger and coffee disease, H. B. EVANS (*Planting Opinion, 4 (1899), No. 51, pp. 1009–1012*).

Cacao disease in Trinidad (*Kew Misc. Bul., 1899, No. 145–146. pp. 1–6, pl. 1*).—This disease, due to *Phytophthora omnivora*, with which is associated *Nectria bainii*, has been noted from another source (E. S. R., 11, p. 362).

On the occurrence of bacteria in abnormal enlargements on roots of Phaseolus multiflorus, O. SCHWAN (*Inaug. Diss., Erlangen, 1898, pp. 36; abs. in Centbl. Bakt. u. Par., 2 Abt., 5 (1899), No. 24, pp. 847, 848*).—An account is given of an abnormal swelling of the roots of *Phaseolus multiflorus* which was caused by bacteria. The organism was separated, cultivated in various media, and its characteristics described.

The parasitism of Phoma reniformis and its rôle in black rot of grapes, N. V. SPESCHNEW (*Ztschr. Pflanzenkrank., 9 (1899), No. 5, pp. 257–260*).—The author states that the black rot of grapes is due both to *Phoma uvicola* and *P. reniformis*, and that both *P. reniformis* and *P. flaccida* are true parasites.

A parasitic disease of Gloxinia, A. OSTERWALDER (*Ztschr. Pflanzenkrank., 9 (1899), No. 5, p. 262*).—A brief note is given on a disease of gloxinias due to Anguillula.

Bordeaux mixture, J. FIELDS (*Oklahoma Sta. Rpt. 1899, pp. 80, 81*).—Brief notes are given for the preparation and application of Bordeaux mixture.

The action of some copper fungicides on potatoes, M. HOLLRUNG (*Jahresber. Vers. Stat. Pflanzenschutz, Halle, 10 (1898), pp. 7–9*).—Experiments are reported with various forms of Bordeaux mixture in which sugar, soap, petroleum, and Schweinfurt green were added to increase the adhesive power or to add in effectiveness as insecticides.

New fungicides for potato diseases, J. F. Favard (*Rev. Hort., 71 (1899), No. [illegible], pp. 451, 452*).—Copper sulphate 2.5 kg., sodium silicate 1.5 liters, sodium carbonate 800 gm., and water 100 liters is said to form a fungicide of great tenacity and efficiency. It is recommended for use on other plants than potatoes, especially on grapes and orchard trees.

ENTOMOLOGY.

Report of the apiarist, J. M. Rankin (*Michigan Sta. Rpt. 1898, pp. 139-142*).—Twenty-five swarms of bees were wintered in a cellar at a temperature which varied from 44 to 48° F. The swarms passed the winter in good condition. A colony which was supposed to be inoculated with bee paralysis did not develop the disease, and the author regards it as impossible to produce the disease in Lansing.

An experiment was conducted with 4 different kinds of foundation, 30 sections being filled with each kind of foundation. These foundations were Root's XXX, Root's Extra Thin Surplus, Dadant's Extra Thin Surplus, and "No Wall." The results indicate that the Root's Extra Thin Surplus foundation was filled better than the other varieties, and contained a smaller percentage of wax. Dadant's Extra Thin Surplus foundation stood next in these respects. A larger percentage of wax was contained in combs built from lighter foundations than in that from heavier ones.

Experiments were conducted to determine the relative advantages or disadvantages of the plain section. Several supers were fitted with plain sections on one side and open top on the other. In every case the bees worked on the plain sections first and they weighed most at the end of the experiment. In seasons when the honey flow is greater the open-top sections would doubtless outweigh the plain sections, but the latter are more easily cleaned and look better on the market.

Four colonies of bees were transferred on August 1 to the midst of a marsh in which wild bergamot, willow-leafed spirea, coreopsis, goldenrod, and boneset were found in abundance. The colonies were returned to the yard on October 7. The average gain of the 4 colonies which were left at home during this time was 8¾ lbs. each, and the average gain of the 4 colonies taken to the marsh was 39 lbs. each.

Work is being continued upon the problem of lengthening bees' tongues. One direct cross was made with the result that a gain of 0.9 mm. in length was obtained.

Notes on insect pests from the entomological section, Indian Museum, E. Barlow (*Indian Mus. Notes, 4 (1899), No. 4, pp. 180–221, pls. 2, figs. 2*).—In this article the following tea pests receive consideration: *Euproctis latifascia*, *Thosea cervina*, *T. divergens*, *Belippa lohor*, *Astycus lateralis*, *Diapromorpha melanopus*, *Cremastogaster rogenhoferi*, and several beetles, Lepidoptera, and scale insects.

Among insects injurious to cereals and field crops, the author mentions *Tanymecus indicus* injurious to wheat, *Leucania unipuncta* attacking jowari, *Oxycarenus lugubris* on cotton, *Agrotis segetis* and *A. biconica* on indigo, *Plutella maculata* on cauliflower, *Rhopalosephum dianthi* on brinjal, *Acridium peregrinum* attacking a variety of plants, and a number of unidentified insects injurious to the potato and sugar cane.

Among fruit-tree pests, the author gives brief notes on Longicorn beetle injurious to the apple tree, the mango caterpillar, and Psychid caterpillar attacking grapevines.

Economic and biological notes are given on a number of forest insects, among which the following may be mentioned: *Eriococcus paradoxus* var. *indica*, *Diaspis calyptroides* var. *cacti*, *Hyblæa puera*, and a species of Chrysobothris.

The author gives a list of ladybirds, and dipterous and hymenopterous parasites which serve to hold in check the depredations of injurious insects in India. R. P. Lambert reports an experiment in driving away locusts by means of firearms and blank cartridges. Complete success was obtained by this method. D. Hooper advises the use of lye of wood ashes in making arsenical insecticides to be used against locusts.

Pieris brassicæ, W. W. Schipper (*Tijdschr. Plantenziekten, 5 (1899), No. 1, pp. 1–11, pls. 3, figs. 3*).—This insect occurred in unusual numbers in the summer of 1898 and was especially injurious to kale. The author observed that the species was more abundant in gardens and small areas which were near houses and other buildings than in the open field.

Notes are given on the habits and life history of the insect. A large proportion of the cocoons were infested with *Microgaster glomeratus*. There are ordinarily 2 generations a year. The first generation requires for its development about 3 months, from May to July. The second generation develops during the period from August to the following April. The winter of 1897–98 was mild and therefore especially favorable to the development of the winter generation.

In discussing remedies to be used against this insect, the author makes the following recommendations: Kale should be planted in open fields as far as possible from houses, barns, walls, trees, etc. Trap crops may be planted near walls and houses, and later destroyed. The author observed that the deposition of eggs and the process of pupation usually took place upon the bark of trees and near houses and garden walls, and that the moths of the second generation came from the open field to such sheltered places for the purpose of depositing their eggs. It is also recommended that cocoons infested with *Microgaster glomeratus* should be spared as far as possible in order that the parasites may develop, and that wild cruciferous plants should not be allowed to grow in or near fields where kale is to be planted.

A study of diseased larvæ of the gypsy moth, A. Bergman (*Ent. Tidskr., 20 (1899), No. 4, pp. 284–286*).—Diseased larvæ of this moth were received from Prof. Lampa. Upon opening one larva which was already dead, a grayish-brown semifluid mass with a rancid odor was found. Cover-glass preparations showed bacteria in large numbers, being for the most part of 2 sorts. The smaller variety, which was from 1.2 to 2.4 microns in length and 0.6 of a micron in breadth, occurred in much larger numbers than the other variety. The same organisms were found in another diseased larva, which was still alive.

The smaller bacteria grew readily upon gelatin agar and glycerin agar, producing gas with a small content of sulphur. The author tried some inoculation experiments with this organism upon *Lymantria monacha* and *Pieris brassicæ.* The larvæ of the former died 2 days after inoculation, while those of the latter were not affected. Hypodermic injections of pure cultures of the organism in white mice produced no pathogenic results.

Insects and diseases affecting the prune, R. W. DOANE (*Washington Sta. Bul. 38, pp. 37–44*).—The author presents brief notes upon the following insects: San José scale, red spider, plum tree aphis, plum curculio and plum gouger. As a remedy for the San José scale, it is stated that experiments in Washington indicate that the lime, sulphur, and salt wash is the most effective spray. Experiments on the treatment of plants for the red spider indicate that the lime, sulphur, and salt wash, or water at a temperature of 150° F., will kill the eggs of the red spider. These experiments were conducted in the laboratory and have not been confirmed by field tests. The plum-tree aphis is said not to be especially destructive to orchards in the eastern part of the State, although it is rather harmful in the western portion. Kerosene emulsion and quassia chips and whale-oil soap solution are recommended as the most useful insecticides against this insect. Brief reference is made to the flat-headed apple-tree borer and peach-tree borer as injuring the plum tree. The plum curculio and plum gouger have not yet been found in Washington.

Report of the entomologist and assistant horticulturist, E. WALKER (*South Carolina Sta. Rpt. 1898, pp. 19–22*).—This is a summary of the entomological work of the station. The making of a collection of the insects of the State is described and attention is called to the need by fruit growers of combative measures against certain kinds.

Observations on the honey-bearing plants of the maritime Alps, P. J. BALDENSPERGER (*L'Apiculteur, 44 (1900), No. 2, pp. 68–72*).—Notes on the chief honey-bearing plants of this region for each month of the year.

Some insect experiences of 1899, M. V. SLINGERLAND (*Proc. West. New York Hort. Soc. 1900, pp. 49–52*).—Brief notes on the codling moth, tent caterpillars, and on arsenical and other spray materials.

Migration and dispersal of insects, J. W. TUTT (*Ent. Rec. and Jour. Variation, 12 (1900), No. 1, pp. 13–16*).—Observations on a number of species of Lepidoptera.

The alfalfa worm (*University News Letter, Lincoln, Nebr., 1900, No. 6, fol.*).—Notes on the extent of injury caused by this insect, with an account of remedies which have been successfully used against it.

Grass insects, H. OSBORNE (*Agr. Student, 6 (1899), No. 3, pp. 57–59*).—As general preventive measures against the numerous insects which are injurious to grass lands, the author recommends the rotation of crops, the use of trap lights, arsenical baits, and the protection of the natural enemies of injurious insects.

Fruit flies, T. W. KIRK (*New Zealand Dept. Agr. Leaflets for Gard. and Fruit Grow-

ri, No. 35, pp. 5, figs. 2).—The author gives notes on *Tephrites tryoni* and *Halterophora capitata*. The latter species is said to be established in Queensland, West Australia, New South Wales, Tasmania, and South Africa. A brief account is given of its life history and of suitable remedies for use in combating it.

Two pineapple pests, C. P. LOUNSBURY (*Agr. Jour. Cape Good Hope, 16 (1900), No. 2, pp. 94–102, figs. 2*).—*Dactylopius longispinus* was probably introduced on infested pineapples from Natal. Thorough inspection of imported pineapple sprouts is recommended. As remedial measures, the author suggests the use of a resin wash and digging up and burning badly infested plants. Fumigation with hydrocyanic-acid gas is not recommended.

Brief notes are given on *D. bromeliæ* and *D. brevipes*. The author presents a brief account of *Aulacaspis bromeliæ*. This scale insect is not yet widely distributed in the pineapple districts of Cape Colony but has been observed on pineapples in greenhouses. The species is well established in Natal. Fumigation with hydrocyanic-acid gas is recommended. One hymenopterous parasite has been bred from this scale.

Enemies and diseases of coffee, H. LECOMTE (*Le café. Paris: G. Carré & C. Naud, 1899, pp. 176–206, figs. 7*).—This article constitutes chapter 12 of the author's book on "Coffee" and contains notes on the various nematode, insect, and fungus diseases of the coffee plant. Among the more important insect enemies, the following may be mentioned: *Xylotrechus quadrupes, Cucujus coffeophagus, Zeuzera coffeæ, Elachista coffeella, Cemiostoma coffeella*, and a number of species of bark lice. *Aræocerus fasciculatus* is mentioned as an enemy of the coffee berry. A list of parasitic fungi which are found upon coffee is given, and notes are presented on some of the more important fungus diseases, among which may be mentioned *Hemileia vastatrix* and *Pellicularia koleroga*.

Insects infesting carnations, F. A. SIRRINE (*Amer. Florist, 15 (1900), No. 613, pp. 909–913, figs. 6*).—Notes on the life history and remedies for *Rhopalosiphum dianthi*, red spider, tobacco thrips, *Peridroma saucia, Plusia brassicæ*, white ants, and *Cacœcia rosaceana*.

A mole cricket (*Jour. Dept. Agr. West. Australia, 1899, Dec., p. 23*).—Recommends poisoned cabbage leaves and the use of carbon bisulphid and kerosene in the ground in the control of this insect.

New contribution to the knowledge of Italian insect galls. Fourth communication, C. MASSALONGO (*Nuovo. Gior. Bot. Ital., n. ser., 6 (1899), No. 2, pp. 137–148*).

Some muscinæ of North America, G. DE N. HOUGH (*Biol. Bul. 1 (1899), No. 1, pp. 19–33, figs. 20*).—Notes on the classification and biology of species belonging to the following genera: Stomoxys, Hæmatobia, Hemichlora, Muscina, Clinopera, Pyrellia, Mesembrina, Graphomyia, and Morellia.

A first list of Acaria collected in Portici, G. LEONARDI (*Ann. Regia Scuola Superiore Agr. Portici, 2. ser., 1 (1899), pp. 493–525*).—A list of mites, together with notes on their hosts and life habits.

The life history of Brachysoma codeti, P. CHRÉTIEN (*Ann. Soc. Ent. France, 68 (1899), No. 3, pp. 451–465, pl. 1*).—The author gives detailed descriptions of the insect in all its stages, together with notes on its relationship to allied species.

The wheat midge (Cecidomyia tritici), S. L. MOSLEY (*Nat. Jour., 9 (1900), No. 91, pp. 13, 14, figs. 5*).—Brief popular notes on this insect.

Notes on the life habits and injurious action of Cetonia, J. RITZEMA-BOS (*Tijdschr. Plantenziekten, 5 (1899), No. 1, pp. 12–23*).—An elaborate discussion of the literature concerning the life habits, especially of the larval condition, of *Cetonia floricola* and other species, and on their host plants.

Craniophora (Acronycta) ligustri var. olivacea, D. T. HAAR (*Tijdschr. Ent., 42 (1899), No. 3. pp. 97–100, fig. 1*).—This insect feeds on the ash. A second brood was produced in an insectary, but these individuals would probably perish if left to themselves during cold autumn weather.

The parasites of Lymantria monacha, C. AURIVILLIUS (*Ent. Tidskr., 20 (1899),* *No. 4, pp. 279–281*).—Records as parasites of this insect *Ichneumon nigritorius, Pimpla instigator, P. examinator, P. arctica, P. brassicariæ, P. quadridentata, P. didyma, Theronia flavicans*, and *Tachina fasciata*.

Life history of "tun twig borer" (Magiria robusta), B. O. Coventry (*Indian Forester, 25 (1899), No. 9, pp. 267–370*).—The larvæ of this insect enter the tun twigs in the axil of the leaves. There are two generations a year. In fighting this insect the author recommends cutting back the shoots which have been attacked about the middle of September.

The elm twig-girdler (Oncideres cingulatus), P. J. Parrott (*Trans. Kansas Acad. Sci., 6 (1899), pp. 200–202, figs. 4*).—Notes on the habits and life history of this beetle.

Physopoda as enemies of sugar peas, F. Trybom (*Ent. Tidskr., 20 (1899), No. 4, pp. 267–277*).—*Pisum sativum* was attacked by a number of species of this order of insects. The author presents descriptive and economic notes on *Thrips physopus, T. communis, Physopus atrata* and *P. robusta*.

Thrips communis was observed feeding upon *Vicia villosa, Onobrychis sativa, Medicago sativa*, and *Lupinus luteus*. *Physopus robusta* attacked *Pisum arvense* as well as *P. sativum*. The author gives a detailed description of the larvæ of *P. robusta*.

Pulvinaria camellicola and means of combating it, G. Leonardi (*Ann. Regia Scuola Superiore Agr. Portici, 2. ser., 1 (1899), pp. 389–403, figs. 11*).—The author gives detailed descriptions of the larval, nymphal, and adult forms of both sexes of this insect. The larvæ appear during the latter part of April and the first part of May. For a period of 3 or 4 days they wander about the host plant with considerable activity in search of a place for fixing themselves. The larvæ attach themselves preferably to the under surface of the leaves, along the midrib and other veins. The adults of the first generation appear during the first week of August and deposit the eggs which develop into the second generation during the latter part of August and the first part of September. The host plants which are preferred by this insect are *Camellia japonica, Euonymus japonica*, and *Podacarpus elongata*.

The San José scale, J. Ritzema-Bos (*Tijdschr. Plantenziekten, 5 (1899), Nos. 2, pp. 33–96; 3–4, pp. 97–127; 5–6, pp. 145–167, figs. 31, map 1*).—This article contains an extended and critical discussion of the literature relating to the San José scale and allied species, including the following subjects: The life habits, methods of reproduction, food plants, injurious action, methods of distribution, conditions upon which the distribution of the insect depends, the various methods which have been adopted for combating the insect, and notes on the habits and life history of *Lecanium persicæ, Mytilaspis pomorum, Aspidiotus camelliæ, A. ostreæformis, Diaspis fallax*, and other related species. A bibliography of American and other work on the San José scale is appended to the article.

The San José scale question from a horticultural standpoint, S. A. Beach (*Proc. West. New York Hort. Soc. 1900, pp. 19–24*).

The enemies of the migratory locusts (Schistocerca paranensis), C. Berg (*Comunic. Mus. Nac. Buenos Aires, 1 (1898), No. 2, pp. 25–30*).—Notes on *Mermis acridiorum, Agria acridiorum*, and *Trox suberosus*.

Depredations of Tipula in meadows, Ewert (*Ztschr. Pflanzenkrank., 9 (1899), No. 6, pp. 328, 329*).—The author makes a report upon an unusually severe attack of the larvæ of crane flies upon the roots of grasses. The larvæ belong to 2 species, *Tipula oleracea* and *T. nigra*. They were found at a depth of from 1 to 2 cm. beneath the surface and were so abundant that from 10 to 20 could be found in a square foot of surface. The grasses were completely killed in the infested areas, as well as all other forms of vegetation, with the exception of reeds and *Plantago maritima*.

Borers in trees, J Fields (*Oklahoma Sta. Rpt. 1899, p. 80*).—Painting the trunks of trees with a mixture of soft soap and a strong solution of washing soda has been used with success in preventing the laying of eggs on the bark.

Killing insects in stored grain, J. Fields (*Oklahoma Sta. Rpt. 1899, p. 81*).—Brief directions are given for the use of carbon bisulphid in killing insects in stored grain.

Destruction of insects, E. E. Bogue (*Oklahoma Sta. Rpt. 1899, pp. 37, 38*).—The author insists upon the timely application of insecticides and calls attention to the value of domestic fowls and the horned toad as insect destroyers.

FOODS—ANIMAL PRODUCTION.

Nitrogen equilibrium in adult man, V. O. Sivén (*Skand. Arch. Physiol., 10 (1899), No. 1–2, pp. 91–148, pl. 1*).—A number of experiments with man are recorded in which the balance of income and outgo of nitrogen was determined. Some of the principal deductions follow:

The experiments show that the adult human organism can remain in nitrogen equilibrium at least for a short time without increasing the fuel value of the diet when the food furnishes only 4.52 gm. of nitrogen (equal to 28.3 gm. of protein per day), and only about 0.2 gm. of the nitrogen is in the form of true albumen. Calculated per kilogram of body weight, 0.08 gm. of nitrogen, of which 0.03 gm. is nitrogen of true albumen, represents the minimum requirement.

When the organism is in nitrogen equilibrium at the lowest limit and the fuel value of the diet is not less than normal, the organism does not lose any of its own protein, either "circulating" or "organic." Further, the amount of protein in the diet is not dependent upon the protein content of the body tissue. The author believes his experiments warrant the deduction that the nonproteid nitrogen compounds in the diet are not as directly excreted from the organism as has been believed. As regards the source of muscular energy, in the author's opinion, all the experiments indicate that muscular contraction takes place at the expense of nitrogen-free nutrients.

Experimental investigations on the effects of muscular work on metabolism and the value of the several nutrients as sources of muscular energy, H. N. Heineman (*Inaug. Diss., Munich, 1898, pp. 51*).—A number of experiments on the value of the different nutrients as sources of muscular energy and the effects of muscular work on metabolism were made with a healthy man. The test covered a number of periods, in which the diet consisted chiefly of protein, of fat, or of carbohydrates. The amount of work performed was measured with a Gaertner ergostadt. The respiratory quotient was measured by means of a Magnus-Levy appaıatus. In a number of the experiments the nitrogen and fuel value of urine were determined, these factors being compared with similar factors in the diet.

The author's principal conclusions were that Chauveau's belief that when fat is burned in the body more energy is required than in case of carbohydrates is incorrect. He regards it as much more probable that the different nutrients are available for muscular work very nearly in proportion to their heats of combustion. In the experiments reported the respiratory quotient for work and rest was the same. Under ordinary conditions the author considers fat and carbohydrates the source of muscular energy. It is not denied that under certain conditions protein may be the sole source of muscular energy.

Some observations on common purslane, P. SCHWEITZER (*Missouri Sta. Rpt. 1898, pp. 84, 85*).—Purslane (*Portulaca oleracea*) was found to have the following percentage composition (in dry matter): Protein 30.43, fat 2.61, nitrogen-free extract 34.24, crude fiber 10.12, and ash 22.60. The length of time which the plants would retain water was tested. On July 11 a quantity of purslane was suspended in a room the temperature of which rose daily to 90° F.

> "In the 19 days' trial the plants had lost 45.74 per cent of water out of a total of 91 67 which they contained; no observation was made between July 30 and September 5, when some leaves were yet green, while the plants had developed blossoms and ripened an abundance of seeds."

Feeding cotton seed, cotton-seed meal, and corn to beef steers, E. R. LLOYD (*Mississippi Sta. Bul. 60, pp. 17–22, 28–32*).—The feeding value of cotton seed, cotton seed meal, and corn-and-cob meal was tested with 3 lots of 2 young steers each, 9 months old at the beginning of the trial. The test proper began December 5, 1898, and covered 4 periods of 30 days each. The grain mixture varied in different periods. The corn-and cob meal was fed alone or in combination with wheat bran, and the cotton seed and meal were both fed with wheat bran and with corn-and cob meal. All the steers were fed Johnson grass hay in the first 3 periods, and alfalfa hay in the fourth period.

Taking the average of the first 3 periods, the author concludes that a pound of cotton-seed meal is equivalent to 1.6 lbs. of cotton seed or 1.92 lbs. of corn, and that a pound of cotton seed is equivalent to 1.22 lbs. of corn. In the fourth period fair gains were made by lots 1 and 2, while there was a slight loss in lot 3 which is accounted for, in the author's opinion, by the condition of one of the steers. The best gains in this period were made with lot 1, "which indicates that the alfalfa hay made a better balanced ration with corn-and-cob meal than did the grass hay."

In discussing the fertilizer constituents recovered in the manure (see also p. 1022), W. R. Perkins and E. B. Ferris record data for determining the balance of income and outgo of nitrogen, phosphoric acid, and potash. The test covered 1 week and included one steer from each of the 3 lots. The results follow:

Balance of income and outgo of nitrogen, phosphoric acid, and potash

Food eaten	Nitrogen				Phosphoric acid				Potash			
	In food	In urine	In feces	Gain	In food	In urine	In feces	Gain	In food	In urine	In feces	Gain
	Oz	*Oz*	*Oz*	*Oz*	*Oz*	*Oz*	*Oz*	*Oz*	*Oz*	*Oz*	*Oz*	*Oz*
Steer 1, 448 oz Johnson grass hay, 784 oz corn and cob meal	12.835	3.510	7.817	1.508	7.290	2.028	3.928	1.334	10.506	7.722	2.301	0.483
Steer 2, 448 oz Johnson grass hay, 448 oz corn and cob meal 224 oz cotton seed meal ...	24.102	10.223	9.748	4.131	13.215	2.850	8.711	1.654	13.619	8.552	3.733	1.334
Steer 3, 448 oz Johnson grass hay, 448 oz corn and cob meal, 336 oz cotton seed	19.756	7.033	9.243	3.480	9.944	1.529	7.378	1.037	13.025	7.415	4.540	1.070

From the data recorded it would be possible to compute the digestibility of the dry matter, protein, phosphoric acid, and potash in the three rations.

Value of cotton seed to the farmer, W. L. HUTCHINSON (*Mississippi Sta. Bul. 60, pp. 1–3*).—The author summarizes the results of tests on the value of cotton seed reported in this bulletin and notes the value of cotton seed for manure and for feeding.

> "The present disposition of the cotton seed crop secures to the farmer a very small part of its real value and must of necessity give place to a practice that will secure to the farmer the maximum benefit which he may derive from this product.
>
> "The time will come when the southern farmer will realize that the fertilizing value in cotton seed must stay on the farm to maintain its fertility and productiveness. . . .
>
> "[It is probable that in the future] there will be a small oil mill at each ginnery and oil and lint will be the only products of the cotton crop sent to market. The southern farmer, however, need not wait for oil mills. He may get the full value of his cotton seed by a judicious system of feeding, accompanied by the most careful saving and proper use of the manure."

Feeding experiments, G. E. MORROW and J. H. BONE (*Oklahoma Sta. Rpt. 1899, pp. 18–32, figs. 3*).—Feeding experiments made from 1896 to 1899 with steers, pigs, mules, horses, sheep, and lambs are briefly reported, the principal object being to test feeding stuffs which can be readily grown under local conditions, and which may be prepared at small cost.

Tests with steers (pp. 24–27).—In 1898–99 Kafir corn and maize were compared with 5 lots of 2 steers each. The test covered 24 weeks. Lot 1 was fed Kafir corn meal; lots 2 and 5, maize meal; lot 3, maize meal and Kafir corn meal, 1:1; all the lots being given a full ration. Lot 4 was fed approximately 1 lb. of Kafir corn meal per hundred pounds live weight for 5 weeks, and afterwards a full ration of the same grain. The average daily gain of the 5 lots in the first 12 weeks of the test was 2.32, 2.75, 2.64, 1.63, and 2.80 lbs., respectively. In the second 12 weeks the corresponding gains were 2.50, 1.63, 1.90, 1.75, and 2.68 lbs., respectively.

In 1897–98, a test was made with 2 lots of 5 steers each. It was divided into 2 periods of 4 and 5 weeks, respectively, with an interval of 2 weeks between. In the first period lot 1 was fed Kafir corn meal and lot 2 corn meal. In the second period, the conditions were reversed. In the first period the average daily gain of the steers fed Kafir corn meal was 3.64 lbs.; of those fed corn meal, 2.21 lbs. In the second period the steers fed Kafir corn meal gained on an average 1.42 lbs. per day, and those fed corn meal 1.69 lbs.

In 1896–97, a test covering 23 weeks was made with 5 lots of 4 steers each. Lot 1 was fed from racks and troughs in a well protected yard. The other lots were fed in box stalls. During the day they had the run of a large lot. The average daily gain of the steers in lot 1 was 2.19 lbs., while the average daily gains of the lots fed in box stalls ranged from 1.63 to 1.84 lbs. The effect of dehorning was observed with 11 of the steers. There was an apparent loss of weight from dehorning, but it is stated that none of the dehorned steers were off feed at any time.

Brief statements are made concerning cotton seed as a feed for cattle, moderate quantities (about 4 lbs. per day) in connection with Kafir corn having given good results. No injury following the use of this feeding stuff has been observed. The gains made by cattle on pasture are briefly spoken of, as well as the marked variations which have been observed in the gains made by different cattle.

Tests with pigs (pp. 27–30).—The value of alfalfa pasturage, with and without grain, was tested with 2 lots of 4 pigs each. In 8 weeks the total gain of the pigs fed alfalfa alone was 68 lbs.; of those fed alfalfa and grain (Kafir corn meal and shelled corn), 324 lbs.

The weight of pigs at birth and the gains made by a number of litters were recorded. The average weight of the pigs in 9 litters at birth ranged from 2.25 to 3.07 lbs., the mean being 2.65 lbs. Gains made by sows fed Kafir corn meal and by pigs following cattle fed Kafir corn on the ear or unground shelled corn were also recorded, as well as the gains made by pigs fed different forage crops. These included sugar beets, cowpeas, sorghum, sweet potatoes, and peanuts. Five trials of the comparative value of Kafir corn and maize for pigs are briefly reported. The average results follow:

Kafir corn and maize for pigs.

No. of pigs.	Ration.	Time.	Average weight at beginning.	Average daily gain.	Grain eaten per pound of gain.
		Days.	*Pounds.*	*Pounds.*	*Pounds.*
6	Kafir corn	42	135	1.11	6.65
8	Kafir corn meal	24	220	1.80	5.60
2	First period corn on ear	35	125	1.53	4.94
	Second period Kafir corn meal	14	178	1.00	9.21
4	First period Kafir corn meal	35	105	1.21	5.08
	Second period. Shelled maize soaked	14	147	.53	7.07
	Third period Shelled maize, soaked, and alfalfa fodder.	28	154	1.25	3.65
4	Corn meal and poor quality ground wheat, 1:2.2	30	170	1.50	5.44

"Alfalfa is excellent as pasture for hogs. Pigs will make some gain with no other food; excellent gains when fed grain while on the alfalfa. Continuous pasturing will injure and may destroy the alfalfa. With rare exceptions, alfalfa should not be pastured the year it is sown. Sorghum also makes a fair pasture for hogs. Sowing cowpeas, planting peanuts or sweet potatoes and allowing hogs to harvest the crop, giving them some grain in addition, reduces the cost of pork production. Sugar beets are much relished by any class of stock. The greater cost of growing them as compared with other crops makes it doubtful if they are an economical crop when used in large quantities."

Tests with horses and mules (p. 31).—Brief statements are made concerning the amount and cost of food consumed, the amount of water drank, and the work performed by horses and mules at the station. When fed Kafir corn and maize, each rated at 20 cts. per bushel, oats at 25 cts. per bushel, and bran at 25 cts. per hundredweight, the average cost of a day's labor was estimated to be 17 cts. On an average a pair of mules and a pair of horses, each weighing 2,130 lbs., drank 107 lbs. of water per day while at moderate work. When idle, during hot summer weather, a pair of mules drank on an average 113 lbs. of water daily and on one day 350 lbs. were drank.

Tests with sheep (p. 32).—Kafir corn heads with prairie grass hay and corn stover was fed to 16 grade Shropshire wether lambs for 13 weeks in the winter of 1898. They remained in good condition and gained a little over ¼ lb. per head per day, consuming a total of 1,624 lbs. of Kafir corn heads.

From all the tests the following conclusions regarding Kafir corn were drawn:

> "Kafir corn is a healthful, palatable, and nutritious food, but its feeding value is somewhat less than that of corn. As shown both by feed lot trials and by digestion experiments, there is a great loss in feeding this grain unthreshed to cattle—in some cases of 60 per cent, but hogs will utilize most of this waste. There is little difference in the waste whether the grain is fed unthreshed or threshed. In some cases, at least, the loss is greater when soaked grain is fed than when it is fed dry. In some trials steers fed Kafir corn meal made better gains for a long time than did those fed corn meal, but this was not true in any extended period. Hogs digest the unground grain better than do cattle. In general, hogs have made gains from four-fifths to five-sixths as great when fed on Kafir as when fed corn. Sheep seem to digest Kafir better than any other class of farm animals.
>
> "Kafir stover apparently has practically the same feeding value as corn stover, and often is in better condition. Running the entire stalk through a threshing machine puts the stover in excellent condition. Alfalfa is the best hay for either horses, cattle, or sheep, and is a help to hogs during winter. The value of cowpea and soy bean hay is underestimated by most Oklahoma farmers. No larger gains have been made by cattle at the station than when cowpea hay was their only rough forage.
>
> "Shelter should be provided for all classes of stock, but expensive buildings and stall feeding of cattle are not necessary. While there is, occasionally, extreme cold, ordinarily protection from rain and cold winds by means of simple sheds is all that is needed for the comfort of farm animals"

Reports on experiments in sheep feeding on turnips, Perthshire, J. W. PATERSON (*Glasgow and West of Scotland Tech. Col., Agr. Dept. Rpts., 1898, pp. 110–119*).—A test was carried on by T. Wylie, of Stockbridge, Dumblane, with 40 sheep, divided into 4 equal lots. They were folded in separate pens on a stubble field. The test began December 19 and covered 93 days. Turnips and hay were fed alone and with the addition of oats and linseed cake and of peas, lentils, and maize. During the latter part of the experiment swedes were substituted for turnips. The principal deductions follow:

> "Turnips and hay alone can not be profitably used in feeding sheep. The turnips should be limited and the deficit made good with concentrated foods. These foods should be rich in flesh formers. Linseed cake should form the larger part in a mixture with oats. Maize may be employed on account of its cheapness, if due regard be had to narrowing the ratio. With a fixed amount of food, most increase is made the first weeks, and the ration should be increased as fattening progresses."

A test made by J. Sterling at Mains of Kippendavie is briefly reported. Three lots of 10 sheep each were fed the same grain rations as in the above test in addition to turnips and hay. The results confirm those of the test at Stockbridge.

An attempt to establish a relationship between the manurial treatment of farm produce and its feeding properties, W. SOMERVILLE (*County Councils Cumberland, Durham, and Northumberland, Tech. Education, Rpt. 7 (1898), pp. 53–63, 113–115*).—In the winter of 1898 a test was made with sheep of the feeding value of turnips and hay which had been grown on plats differently fertilized. No definite conclusions were drawn.

A similar experiment was made in the winter of 1898–99 with 18 lots of sheep, the lots containing 5 or 6 sheep each. The test covered 14 weeks. The feeding stuffs tested were turnips, hay, and oat hay. These crops had been fertilized with bone meal, nitrate of soda and superphosphate, sulphate of ammonia and superphosphate in different proportions, and superphosphate alone. In addition to turnips, hay, or oat hay, all the sheep were given a small amount of oats (⅓ to ½ lb. per head daily). The average gains in the 14 weeks of the test ranged from 12.6 to 20.9 lbs. The principal conclusions follow: Compared with hay as a standard, the bone meal produced the most nutritious feed, but, in the author's opinion, this factor does not compensate for the lower yield. Nitrate of soda and sulphate of ammonia gave the same yield of hay and produced practically the same gains in live weight. A double amount of sulphate of ammonia increased the hay crop, but diminished the gains made by the sheep.

The effect of feeding sheep under cover, out of doors, on grass pasture and on turnip land was also discussed. When fed under cover, the average gains in 14 weeks was 20.9 lbs.; when fed out of doors, 20 lbs.; when hurdled on turnip land, 18.9 lbs., and when on grass pasture, 16.6 lbs.

The advantages of the different methods of handling sheep are discussed at some length.

Feeding cotton seed to hogs, E. R. LLOYD (*Mississippi Sta. Bul. 60, pp. 26, 27*).—Two tests of the value of raw and cooked cotton-seed meal for hogs are briefly reported. The first test, which covered 12 weeks, was made with 4 lots of 2 Berkshire hogs each. Cooked cotton seed and raw and cooked cotton-seed meal were fed with corn meal or whole corn to different lots. No figures are recorded for gains in weight, etc.

"The gain made by the lots was neither satisfactory nor profitable. The hogs began to die first in the lot getting raw cotton-seed meal. The first hog died at the end of the fourth week, and at the end of the eighth week the remaining hogs in the same lot died. While the hogs getting the cooked seed and meal did not die, some were very sick and refused to eat and would get better and begin eating again after being allowed to run in an oat and clover patch for several days. After the fourth week most of the hogs began to lose flesh, and after the sixth or eighth week none of the lots made gains."

In the second test 23 pigs 4 months old were fed for 46 days a ration consisting of cooked cotton seed, corn meal, shorts, and skim milk. During the first 2 weeks there was an average daily gain of 1 lb. Afterwards the gains were small.

"The pigs continued to eat with great relish, leaving no waste. At the end of 40 days the pigs began to die, and when the experiment closed 4 pigs had died and several others were sick, but were turned into a clover lot and were apparently well in a week. Some of those pigs were kept until grown and put on feed to fatten for market. The cotton-seed pigs were poor feeders, and were never gotten in good condition. . . .

"Until some method is devised by which the poisonous element in the feed can be cheaply and completely extracted, cotton seed and its products can not be considered as a feed for hogs."

Poultry experiments during the year 1898–99, F. E. EMERY (*North Carolina Sta. Bul. 167, pp. 391–416*).—In this bulletin, which summarizes the work of the poultry department of the station for 1 year, tests of the comparative value of different crosses and breeds, the advisability of selling eggs by weight, and "feeding flavor into eggs" are reported.

Class vs. class and breed vs. breed; rations for hens and methods of feeding (pp. 391–402).—A number of breeds of the Mediterranean class (Black Minorcas and Single-comb Brown Leghorns), the American class (Barred Plymouth Rocks, White Plymouth Rocks, and Silver-laced Wyandottes), and the Asiatic class (Buff Cochins, Black Langshans, and Light Brahmas) were compared, each class including both pullets and hens. All the lots were fed bran, wheat middlings, and corn meal, 4:2:1, in the morning, wet up with steamed crimson clover, and usually cut fresh bone. In the afternoon different whole grains, including oats, wheat screenings, corn, and cracked corn, were fed alone and in combination. The composition of the different feeding stuffs is reported. The financial statements are based on corn and corn meal at 55 cts. per bushel; crimson-clover hay at 75 cts., green bone and wheat middlings each $1, oats $1.40 to $1.60, wheat bran 90 cts., and wheat screenings 80 cts. per hundred pounds; and eggs at 13½ cts. per dozen.

The results comparing the different classes of chickens are summarized as follows:

Results of tests with different classes of hens.

	Eggs laid per hen per month	Cost of production per month.	Maximum monthly profit above cost of food.	
			All eggs rated at 13 5 cts per dozen	Eggs rated at 13 5 cts per dozen of 17 5 oz
		Cents	*Per cent.*	*Per cent.*
American class	11.60	8 94	38 26	199.35
Asiatic class	11.30	10 68	11 05	168.35
Mediterranean class	11.04	6.24	87.50	147.12

The different breeds are compared at some length.

> "The leading breeds in this comparison are Brown Leghorn, Barred Plymouth Rock (counting the late hatch hens only), Black Langshan, and White Wyandotte. If Silver-laced Wyandotte were represented by mature fowls as good in proportion as the pullets they would stand second best in rank in economy of production.
>
> "As far as this record goes it shows that for high production, weight of eggs produced, as well as for economy in production, pullets far outstrip hens. Young vigorous stock is the best stock to keep for profit."

Should eggs sell by weight? (pp. 403-405).—On the basis of the above tests the desirability of selling eggs by weight is discussed.

> "The heaviest eggs are from the ducks. These weigh nearly 2¼ lbs. per dozen. The average weights of the ducks is but 4.1 lbs. The Light Brahma hens lay the largest eggs, and these are 1¾ lbs. per dozen. The lightest eggs are from Leghorn pullets, a little under 1⅛ lbs. per dozen."

At the same price per dozen, if the Leghorn eggs are worth 13½ cts. per dozen or 12 cts. per pound, the eggs of the other breeds would be actually worth from 16.3 cts. for the Single-comb Brown Leghorns to 21.6 cts. for the Light Brahma; or from 20.7 to 60 per cent in excess of their market value. The eggs of the Pekin ducks would be worth 26.7 cts., or 97.8 per cent above their market value.

Feeding flavor into eggs (pp. 505, 506).—Chopped wild onion tops and bulbs were mixed with the feed of 12 hens of different breeds. After the onion flavor was noticeable in the eggs, the onions were discontinued. The principle conclusions of the test follow:

> "Flavors can be fed into eggs. Therefore it appears that to insure fine-flavored eggs it is necessary to restrict the runs enough so no considerable amount of the food can be of such a character as to yield ill-flavored eggs. It is probable that the flavor caused by eating onions is not noticeable after a week's abstinence."

Experiments with chickens, E. P. NILES (*Virginia Sta. Bul. 96, pp. 6*).—Brief statements are made concerning the breeds and crosses of chickens raised at the station.

> "[White-crested Black Polish crossed with common barnyard fowls] produced a most excellent chicken. The crest was not entirely lost but was reduced about one-half in size and was invariably black. The cross was of medium size, rather long-legged, wild, and good rovers. The flesh had a gamy flavor, was fine grained, and, we should say, as a table fowl could not be excelled. . . . [From the Partridge Cochin crossed] on the common fowl we have got good results. The product of the cross varies in color but is much inclined to buff and many of the characteristic points of the Cochin are retained. We do not know, however, that the laying qualities are improved. Considering the cross from the standpoint of the 'scrub,' we consider it a very desirable one. . . .
>
> "During the present year we have tried crossing the White Indian Game on the White Cochin and the results have been most excellent. One dozen White Cochin hens were mated with a White Indian Game rooster in the spring, and as the mating was late no early chicks were hatched. In due time, however, the eggs were found to be fertile and hatched excellently, almost every egg putting forth a strong, healthy chick. . . .
>
> "For the table [the crosses] are unsurpassed. The meat is fine in texture, of a gamy flavor, and not dry as is the flesh of many fowls; breast full and plump and

legs and thighs large. The chicks are extremely hardy, scarcely one being lost after hatching. They require but little attention, are good rangers, and, on the farm, would forage for their own living under ordinary circumstances."

Bread from a mixture of flour and corn meal or corn flour, W. O. ATWATER (*New York State Lunacy Com. Rpt 1897–98, I, pp. 379–381*).—The composition of 2 samples is reported. One sample, apparently made of 75 per cent of wheat flour and 25 per cent of yellow corn meal, had the following composition: Water 32.2 per cent, protein 9.7, fat 2.0, carbohydrates 54.8, and ash 1.3. Another sample, made apparently from a mixture of 75 per cent of wheat flour and 25 per cent of white corn meal, contained: Water 29.7 per cent, protein 9.4, fat 2.7, carbohydrates 56.8, and ash 1.4. In a discussion of the report the successful use for bread making of white corn flour mixed with wheat flour at a number of the New York State hospitals for the insane is noted.

The place of sugar in the diet, A. DROUINEAU (*Med. Modern., 9 (1898), No 91, pp. 721, 722*).—A discussion and review of recent work on this subject.

Sugar: Its value as a nutrient and its relation to muscular work, A. DROUINEAU (*Gaz. Hôp., 72 (1899), No. 102, pp. 937–945*).—A critical review of the subject, with many citations.

Nutrition experiments in the maneuvers of 1898, LEISTIKOW (*Deut. Mil. Ztschr., 28 (1899), No. 3, pp. 129–141*).—The author reports tests on the value of tropon, maté, and sugar in the ration of soldiers during the maneuvers. The tests are briefly discussed. Tropon had apparently no especially beneficial effect. Sugar was readily eaten. It checked hunger and thirst, but caused no gain in weight or apparent effect on the muscular work performed. Maté was found to be a satisfactory beverage.

Japanese edible fungi, P. HENNINGS (*Notizbl. K. Bot. Garten u. Mus., Berlin, 2 (1899), No. 20, pp. 385, 386*).—Five sorts of edible fungi are described. An abundance of material enabled the author to amplify or correct some of the statements made by J. Schröter.[1]

Examination of commercial vinegars sold in the State at retail, P. SCHWEITZER (*Missouri Sta. Rpt. 1898, pp 85, 86*).—Eleven samples of vinegar were examined. "Four are either known or pronounced to be cider vinegars, while the other 7, though sold under this name, are nothing but malt or alcohol vinegars."

Swiss food book (*Schweitzerischer Lebensmittelbuch. Bern: Neukomm & Zimmerman, 1899, pp. VII+222; rev. in Oesterr. Chem. Ztg., 2 (1899), No. 20, pp. 527, 528*).—This volume contains the Swiss official methods for the examination of foods and condiments.

The composition and feeding value of frozen wheat, L. FOSTER (*Utah Sta. Press Bul., pp. 3*).—The composition of high-grade frozen wheat, low-grade frozen wheat, and first and second grade wheat screenings, is reported, the average composition of ordinary wheat being quoted for purposes of comparison. On the basis of tests at the Canadian Experimental Farms (E. S. R., 6, pp. 452, 466), the value of frozen wheat is discussed.

Feeding animals wheat (*Semaine Agr., 19 (1899), No. 972, pp. 420, 421; 20 (1900), No. 974, pp. 13, 14*).—This general discussion is made up of quotations from articles by L. Grandeau and Couteaux, which appeared in the *Temps*.

Investigations on the composition of French and foreign soft wheats, A. GIRARD and M. FLEURENT (*Bul. Min. Agr. [France], 18 (1899), No. 6, pp. 1032–1154, figs. 2, dgm. 1*).—The composition of a large number of samples of French and foreign wheats is reported. The analytical methods followed are described.

Nutritive value of beet pulp (*Semaine Agr., 19 (1899), No. 972, p. 419*).—The composition of ensiled beet pulp (both from maceration and diffusion process) is quoted from Sydersky, and a ration is suggested for cattle and sheep, of which this forms a part. The work of other investigators is cited.

---

[1] Gartenflora, 35 (1886), pp. 101, 134.

Composition of cowpeas and millet grown on college farm, P. Schweitzer (*Missouri Sta. Rpt. 1898, p. 84*).—The composition of cowpeas cut when the pods were beginning to ripen and millet cut in the dough stage is reported.

Cowpea vine hay, A. M. Soule (*Tennessee Sta. Press Bul. 12, p. 1*).—The feeding value of cowpeas is discussed and the digestibility of this feeding stuff compared with that of other standard crops.

Analyses of new dairy foods, P. Schweitzer (*Missouri Sta. Rpt. 1898, pp. 111, 112*).—Tabulated analyses are given of 5 samples of by-products of oat-meal mills and glucose factories used extensively by dairymen in the vicinity of St. Louis.

Ensilage, F. Gillanders (*New Zealand Dept. Agr Rpt. 1899, pp. 168, 169, pl. 1*)—The manufacture at the Momohaki Experiment Station of stack silage is described and its successful feeding to steers reported. According to the author, when building the stack a piece of 1¼ or 1½ in. galvanized-iron pipe should be inserted horizontally. An ordinary thermometer can then be used to ascertain the temperature of the interior of the stack.

"Sweet ensilage is made at a temperature ranging from 125 to 160° F. A temperature higher than 160° should be avoided. Sour ensilage is made at a low temperature, ranging from 85 to 125°. Sour ensilage is considered the best for milk production, sweet for fattening. The temperature is regulated by the pressure applied to the stack or silo. The greater the pressure, the less the temperature."

Feeding corn and Kafir, J. Fields (*Oklahoma Sta. Rpt. 1899, pp. 71-74*).—Results obtained at the Kansas Station with Kafir corn are quoted as well as the principal conclusions obtained in digestion experiments with Kafir corn at the Oklahoma Station. These were abstracted from another publication (E. S. R., 11, p. 277). The composition of Kafir corn before and after passing through the digestive tract of steers is also reported. The author points out that the small hard grains were but slightly affected by the digestive juices. The author also suggests a system of nomenclature, based on current usage, for Kafir corn and Kafir corn products.

The formation of fat in the animal body under the influence of phosphorus, J. Athanasiu (*Arch. Physiol. [Pflüger], 74 (1899), No. 11-12, pp. 511-560*).—Experimental work with discussion and an extended bibliography of the subject is given. This work is of interest since it bears on the question of the formation of fat from protein.

On the formation of sugar from protein (glycogen formation without glycogen) R. Lépine (*Semaine Med., 19 (1899), No. 972, pp. 417-419*).—A critical review of the subject with many citations and references to the literature.

Differences in the ultimate composition and the experimental and calculated thermal values of feed and feces, P. Schweitzer (*Missouri Sta. Rpt. 1898, pp. 101, 102*).—The elementary composition and fuel value of timothy hay and a number of samples of feces from steers fed this hay were determined.

A proposal to establish a meter-gram-day system of notation for the unification of physiological measurements, J. de Rey-Pailhade (*Projet d'établissement d'un système metre-gramme-jour pour l'unification des mesures physiologiques. Toulouse: Lagarde & Sebille, 1899, pp. 8*).—In accordance with a recommendation made at the congress of physiologists in Cambridge, England, in 1898, the author has elaborated a system for the decimal notation of time. The suggested units are a centième, equal to 14 minutes and 34 seconds; a millième, equal to 1 minute and 26.4 seconds, and a cent-millième, equal to 0.864 second. Examples are given of the use of these units in expressing physiological observations which have to do with the expressions of values for a unit of time, such as food consumed, oxygen consumed and liberated, etc. A simple table is given for recalculating ordinary measurements of time to the proposed system.

Experiment on rearing four kinds of cattle at Cockle Park, W. Somerville (*County Councils Cumberland, Durham, and Northumberland, Tech. Education, Rpt. 7 (1898), pp. 65-67 and 116*).—The results obtained in crossing Polled Angus, Galloway, and West Highland heifers to a Shorthorn bull are reported in some detail. In the author's opinion practically the same results were obtained with Shorthorn and Galloway crosses; the Highland cross ranked next, and the least satisfactory results were obtained with the Polled Angus cross.

Calf rearing, W. SOMERVILLE (*County Councils Cumberland, Durham, and Northumberland, Tech. Education, Rpt. 7 (1898), pp. 73, 74*).—The following is recommended as a satisfactory feed for young calves: Flour, 1 part; ground flaxseed, 2 parts; ground linseed cake, 3 parts. Two and a half pounds of this mixture is considered a day's allowance for a calf. According to the author, it should be scalded with boiling water and sufficient water added to make 2 gal. It should be fed in 3 meals, a little salt and sugar being added before feeding. It is recommended that "it should gradually be made to take the place of new milk after the first fortnight."

Calf rearing, W. SOMERVILLE (*County Councils Cumberland, Durham, and Northumberland, Tech. Education, Rpt. 8 (1899), p. 95*).—Brief statements are made concerning the successful use of boiled linseed oil and codliver oil as a supplement to skim milk in feeding calves.

Raising young cattle, W. SOMERVILLE (*County Councils Cumberland, Durham, and Northumberland, Tech. Education, Rpt. 8 (1899), pp. 96, 97*).—A brief note on the cost of keeping 2 bullocks from birth until 17 months old and 4 heifer calves from birth until 23½ months old.

Sheep breeding experiment, W. SOMERVILLE (*County Councils Cumberland, Durham, and Northumberland, Tech. Education, Rpt. 7 (1898), pp. 51–53, 112*).—In 1897 a breeding experiment was made with 30 Cheviot, 30 Black-faced, and 30 mule ewes. The Cheviots were bred to a Border-Leicester, the Black-faced to an Oxford, and the mules to a Suffolk ram. "The Cheviot has proved the most prolific and the Black-faced least so, but perhaps just because most prolific, the average weight of the Cheviot crosses is the lowest of the three. In this respect the mule crosses came out best."

Sheep feeding, W. SOMERVILLE (*County Councils Cumberland, Durham, and Northumberland, Tech. Education, Rpt. 8 (1899), pp. 94, 95*).—The value of turnips in addition to pasture for sheep was tested for 8 weeks by W. T. Lawrence at Newton Rigg Penrith with 2 lots of 15 crossbred sheep. Both lots received a basal ration of ¼ lb. of linseed cake, and ¼ lb. of oats per head daily, with hay *ad libitum*. In addition lot 1 was fed turnips and lot 2 was pastured. The average weight of the sheep in the 2 lots at the beginning of the test was 98 lbs. and 102 lbs., respectively. Lot 1 made a total gain of 208 lbs. while lot 2 lost 30 lbs. The 2 lots consumed 410 and 300 lbs. of hay, respectively.

The production of crosses and mongrels of the Yorkshire and Casertana races of swine, S. BALDASSARRE (*Ann. Regia Scuola Superiore Agr. Portici, 2. ser., 1 (1899), pp. 1–204, figs. 63*).—This paper contains a historical account of the Yorkshire and Casertana races of swine, together with an elaborate discussion of experiments conducted in producing crosses and mongrels between these races.

The results of the author's experiments are summarized under the following heads: The effects of crossing upon the duration of gestation; upon fecundity; upon the growth, weight, and conformation of the body; upon the pigmentation of the skin; and upon the characters of the skull.

The Penycuik experiments, J. C. EWART (*London: Adam & Charles Black, 1899, pp. XCIII + 177, figs. 34*).—The author describes his experiments in crossing a zebra with mares, and discusses them in their bearing upon the theory of telegony and reversion. In an extended introduction the general subject is discussed at considerable length.

DAIRY FARMING—DAIRYING.

The amount of food consumed by a cow producing a large quantity of milk and butter, W. B. CADY (*Missouri Sta. Rpt. 1898, pp. 113–123*).—A record was kept of the amount of food consumed by a Holstein cow during a 7-day milk and butter test. The cow weighed 1,150 lbs. and had been fresh 57 days at the beginning of the test. During the 7 days the cow consumed daily 15 lbs. of wheat bran, 3 lbs. of old-process linseed meal, 13.31 lbs. of ground corn and oats, and an average of 39.24 lbs. of corn silage and 7.57 lbs. of clover hay.

Analyses were made of the feeding stuffs, and a table shows the amount of total and digestible nutrients consumed.

The food consumed during the test was valued at $1.78. The total yield of milk was 420.86 lbs., containing 16.32 lbs. of fat, calculated equivalent to 20.4 lbs. of butter. With milk at $1.05 per 100 lbs. or butter at 20 cts. per pound, the net profit is estimated at $2.64 or $2.30, respectively. A daily milk record of the cow for 55 days previous to the test is also given.

A test of another cow, in which, however, the exact amount of food consumed was not determined, showed a net profit in 7 days of $2.70 or $1.40, corresponding respectively to the prices of milk and butter given above. "It is very clear that even under this high feeding, in this case at least, cows of great milk-producing capacity were able to return a good net profit."

Feeding experiments and milk records, F. E. EMERY and J. M. JOHNSON (*North Carolina Sta. Bul. 169, pp. 20*).—Tabulated data showing the amount of food consumed and the yield of milk and fat are given, with comments, for 8 feeding experiments, conducted during 1897 and 1898. The tests were made with from 1 to 5 cows, and extended over 3 or 4 periods of 10 days each. The yields of milk and fat were averaged from the records of the last 4 days of each period. Corn silage was fed with all the rations mentioned below.

Wheat bran and rice bran were compared in rations containing, in addition, corn bran and cotton-seed meal. The trial included 3 cows. The rice-bran ration was fed during the first and fourth periods and the wheat-bran ration during the second and third periods of the test. A greater yield of milk and fat was obtained on the rice-bran ration.

In a second test wheat bran alone was fed to 2 cows during the first and third periods and rice bran alone during the second period. The conclusion is drawn that rice bran with silage is insufficient to make a properly balanced ration for a milch cow.

A test with 2 cows was made of wheat bran vs. rice bran in combination with cotton-seed meal. The wheat-bran ration was fed during the first and fourth periods and the rice-bran ration during the second and third. A greater yield of milk was obtained on the wheat-bran ration. A slightly larger yield of fat on the rice-bran ration is considered within the limit of error.

Wheat bran alone and a mixture of equal parts of wheat bran and wheat middlings were each fed to 2 cows during 2 periods. "This experiment points to a decided gain in yields by the use of wheat middlings in the ration when fed at the rate of 50 per cent."

A ration of wheat bran and cowpea meal, 2:1, in connection with silage, was compared with a similar ration containing about 3 lbs. of millet hay in addition. The first ration was fed to 4 cows during the first and fourth periods, and the millet-hay ration during the second and third. Four cows were used in the test. On the whole, the effect of the addition of millet hay was considered scarcely perceptible. During the fifth and sixth periods of the test cowpea meal and cotton-seed meal, fed in connection with wheat bran and silage, were compared, with results favorable to cotton-seed meal. The addition of green crimson clover to the cotton-seed meal ration during a following period showed no very marked results.

Comparisons were made of mixtures of (1) wheat bran and cotton-seed meal, 2:1, with rice bran and cotton-seed meal, 2:1, and (2) wheat bran and cotton-seed meal, 2:1, with wheat middlings and cotton-seed meal, 2:1. Each test was made with 1 cow and covered 4 periods. The tests indicated no marked difference in the feeding value of wheat bran as compared with rice bran and wheat bran as compared with wheat middlings when fed with one-half their weight of cotton-seed meal.

A mixture of wheat bran and cotton-seed meal 2:1, was compared with wheat bran alone. Two cows were used and the test covered 4 periods. During the first and fourth periods the grain mixture was fed, and during the second and third the bran alone. The results showed a difference of 4.75 per cent for milk production and 13.51 per cent for fat production in favor of the mixture of wheat bran and cotton-seed meal over wheat bran alone.

The record of the station herd from 1891 to 1899 is reviewed. The largest yield of milk was obtained in 1896, and averaged 5,672.6 lbs. for 7 cows.

Feeding cotton seed, cotton-seed meal, and corn to dairy cows, J. S. Moore (*Mississippi Sta. Bul. 60, pp. 4–13*).—Tests were conducted during two winters to determine the relative feeding value for dairy cows of cotton seed, cotton-seed meal, and corn-and-cob meal. Each test included 2 lots of 4 cows each and lasted 4 weeks. The 2 lots in each case received the same basal ration of peavine hay, silage, and wheat bran. The work is reported in tabular form and conclusions are drawn.

Three tests were made comparing respectively 3, 3½, and 4 lbs. of cotton-seed meal with 6 lbs. of cotton seed. Cows fed the cotton seed gave a better yield of milk than cows fed 3 lbs. of cotton-seed meal, nearly the same as cows fed 3½ lbs., and a decidedly lower yield than cows fed 4 lbs. of the meal.

In 2 tests a comparison was made of cotton seed and corn-and-cob meal. Lot 1 in the first test was fed 6 lbs. of corn-and-cob meal for 3 weeks and 8 lbs. for the remaining week of the test. Lot 1 in the second test was fed 8 lbs. of corn-and-cob meal. Lot 2 in both tests received 6 lbs. of cotton seed. In neither test was the yield of milk from the cows fed corn-and-cob meal equal to that from the cows fed cotton seed.

Rations containing 3 and 3½ lbs. of cotton-seed meal and 6 and 8 lbs. of corn-and-cob meal, respectively, were compared in 3 tests. The ration containing 3 lbs. of cotton-seed meal gave the lowest yield of milk and the one containing 3½ lbs. the highest. A larger yield of milk was obtained from feeding 6 lbs. of corn-and-cob meal than from feeding 8 lbs. On the ration containing the larger quantity of meal the cows gained materially in weight with a decrease in milk flow.

The author summarizes the results obtained regarding the relative value of the different feeding stuffs as follows:

> "(1) One pound of cotton seed is equal to 1.17 lbs. of corn-and-cob meal (corn meal), or to 0.58 lb. of cotton-seed meal.
>
> "(2) One pound of cotton-seed meal is equal to 1.71 lbs. of cotton seed, or 2 lbs. of corn-and-cob meal.
>
> "(3) One pound of corn-and-cob meal is equal to 0.50 lb. of cotton-seed meal, or 0.85 lb. of cotton seed."

Influence of the feed on the quality of milk and butter, J. S. MOORE (*Mississippi Sta. Bul. 60, pp. 14–16*).—In the feeding experiments noted above determination by the Babcock tester showed no changes in the fat content of the milk that could be ascribed to the different feeding stuffs used.

The following statement is made relative to the effect of food on the butter fat:

> "The average melting point of butter made from cows fed 5 lbs. of cotton-seed meal a day, as determined by several tests made by this station, is 100.1° F., while that from cows fed corn meal and wheat bran as a grain ration is 96.8° F. The butter from the cotton-seed meal or cotton seed is therefore firmer and will stand shipment better during the summer months than will that made from cows receiving no cotton seed or meal."

In a study of the effect of food on the quality of butter the station herd was fed 2 weeks a ration containing 5 lbs. of cotton-seed meal, 10 lbs. of peavine hay, 20 lbs. of corn silage, and 4 lbs. of wheat bran. During a second period of 2 weeks 6 lbs. of cotton seed was substituted for the cotton-seed meal, and during a third period of the same length this was replaced by corn-and-cob meal.

The butter made from the milk obtained during the last 2 days of each experiment was scored by experts. The results are given by the author as follows:

> "The butter made from the herd when it was getting cotton seed scored 96 points out of a possible hundred, which was the same score as that made by the butter from the herd getting corn-and-cob meal. The score of the butter made from the

herd getting cotton-seed meal was 95½ points. There is such a slight difference between the scores that the quality is practically the same for the different feeds. The quality of the butter was not injured by feeding as much as 5 lbs. of cotton-seed meal or 6 lbs. of seed."

Feeding experiments with pumpkins for milch cows, O. MOMSEN (*Milch Ztg., 29 (1900), No. 1, pp. 6, 7*).—Pumpkins and mangel-wurzels in rations otherwise alike were compared in an experiment with one cow. The test covered 3 periods, the first extending over several weeks and the second and third lasting 8 days each. The pumpkins were fed during the second period. The yields of milk, fat, and total solids are given for each milking during the last 3 days of the different periods. On pumpkins the average daily yield of milk was lower, but the yield of fat was higher than during the other 2 periods. The percentage of solids as well as of fat was also higher in the second period. The test is considered as showing that pumpkins are a useful food for milch cows and that they produce more fat than the same quantity of mangel wurzels.

The relation of food to milk fat, L. ANDERSON (*New York Cornell Sta. Bul. 173, pp. 43, dgms. 6*).—The author summarizes 44 experiments by various investigators concerning the relation of food to the fat content of milk, and reports 2 experiments with rations having different nutritive ratios, and 1 with rations containing varying quantities of palm-nut meal. The 44 experiments are classified, in answer to the question as to whether the percentage of fat in the milk was apparently increased by the food, as follows:

Number of experiments in which the fat content was increased by feeding.

	Yes.	No.	A tendency to increase.
Feeding fat	4	8	1
Feeding protein and mixed foods	3	20	3
Feeding watery foods	......	2	....
Feeding molasses preparations	3	.....	....
Total	10	30	4

"Of the 4 experiments where the fat in the food increased the proportion of milk fat, one reports so great a reduction in the yield as to make such feeding unprofitable. The noted experiment of Soxhlet, whereby he increased the percentage of milk fat by feeding the cows oil emulsified in the drinking water (E. S. R., 8, p. 1016), has been repeated many times by other experimenters, but none of them, so far as we know, have reached a similar result. The protein foods which increased the percentage of fat were palm-nut meal and sugar meal The molasses preparations may owe their power to increase the fat content of milk to their rather abnormal character."

The first experiment reported by the author was conducted by J. M. Johnson and extended from November 6, 1895, to April 7, 1896. Three lots of 3 cows each were fed from 8 to 10 lbs. per day of grain mixtures composed of linseed meal and oat chop, with and without gluten feed and cotton-seed meal or corn meal, together with corn silage and clover hay for lots A and B, and corn silage and timothy hay for lot C. The grain mixture was constant for each lot. The nutritive ratios of the 3 rations were: Lot A, 1:4.5; lot B, 1:6; and lot C, 1:9.

The second experiment was conducted by the author and lasted from November 11, 1896, to April 13, 1897. With the exception of one cow the same lots were used as in the first experiment. The lots received 8 to 12 lbs. per day of grain mixtures composed of wheat bran and corn meal or cotton-seed meal, with and without gluten meal or linseed meal. The coarse fodder was, as before, corn silage with clover or timothy hay. The nutritive ratios were: Lot A, 1:4.3; lot B, 1:5.7; and lot C, 1:9.3. In both experiments each lot received mangel-wurzels in addition for a portion of the period.

Tables give the average weekly record of food consumed and milk and fat produced by each lot during the 2 experiments. The data are also shown by means of diagrams and are discussed. Omitting the first 2 weeks of each experiment, the average percentages of fat for periods of 4 weeks each for the 3 lots during the 2 experiments are shown in the following table:

Fat content of milk of cows fed narrow, medium, and wide rations.

	First experiment.			Second experiment.		
	Lot A, narrow ration.	Lot B, medium ration.	Lot C, wide ration	Lot A, narrow ration.	Lot B, medium ration.	Lot C, wide ration.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
First four weeks	3.46	3.40	3.47	3.29	3.77	3.93
Second four weeks	3.29	3.14	3.32	3.24	3.44	3.85
Third four weeks	3.44	3.37	3.27	3.23	3.47	4.07
Fourth four weeks	3.54	3.55	3.47	3.28	3.49	4.07
Fifth four weeks	3.68	3.65	3.68	3.34	3.56	....

"In the first experiment there was an increase from the beginning to the end with each lot of about two-tenths of one per cent of fat. In the second experiment this increase was about one-tenth of one per cent. . . .

"Taking both experiments into account, it would seem that the medium ration had a more favorable influence upon the continued production of milk and total butter fat than either the wide or narrow rations. Yet, if individual cases are considered, we find Belva 2d, on the narrow ration, holding out in her milk flow during both years as well as, or better than, any of the cows on the medium ration."

The effect of the palm-nut meal upon the percentage of fat in milk was studied in a trial conducted by G. N. Lauman. The experiment included 2 lots of 3 cows each and lasted 2 weeks. In addition to corn silage and hay, lot 1 was fed a grain mixture of palm-nut meal, gluten feed, and wheat bran, 2:2:1, and lot 2 a mixture of palm-nut meal, gluten feed, cotton-seed meal, and wheat bran, 4:3:2:1. The quantity fed lot 1 was constant throughout the experiment, while that fed lot 2 was increased several times. The nutritive ratio for lot 1 was 1:6; that for lot 2 varied from 1:5.16 to 1:4.64. A table gives the record of each cow during the experimental period and also for the 6 weeks preceding and following, when the grain mixture consisted of gluten

feed, cotton-seed meal, and wheat bran. 3:2:1. Averages are given in the following table:

Fat content of milk of individual cows on different rations.

	Lot 1.			Lot 2.		
	Gliata Netherland.	Gem Valentine.	Mollie	Mabel 2d	Ruby	Sadie.
Usual ration:	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent*	*Per cent.*	*Per cent.*
First three weeks	3.06	5.28	2.98	3 94	....	3 21
Second three weeks	3.39	5.09	2.92	3 77	3.67	3.63
Palm-nut meal ration:						
First three weeks	3.32	5.80	3 27	4.32	3.26	3.28
Second three weeks	3 64	5.80	3 45	4 35	3.27	3.58
Usual ration:						
First three weeks	3 47	5.80	3.31	3.78	3.00	2.92
Second three weeks	....	5.84	3.30	4.03	3.14	3.48

"Taking everything into consideration, we do not feel warranted in saying that the feeding of palm-nut meal increased the percentage of fat in the milk. . . . There were variations in the fat content of the milk, but no more nor greater than when the food of the cows was unchanged."

The importance of bacterial tests in the sanitary supervision of milk supplies, M. O. LAIGHTON (*Science, n. ser., 11 (1900), No. 273, p. 461*).—In a paper read before the Society of American Bacteriologists, 1899, the author reported bacterial tests of the milk from 17 dairies in the vicinity of Montclair, N. J., for a period of 3 years ended June, 1899. Only the number of germs per cubic centimeter was determined. On the basis of the results for 3 years the dairies were grouped into 3 classes, according to the germ content of the milk, *i. e.*, (1) dairies having an average below 15,000 per cubic centimeter, (2) those between 40,000 and 70,000, and (3) those above 180,000. The dairies of class 1 were of the most improved type in which utmost cleanliness prevailed. Those of class 2 were poorly equipped, although the owners plainly endeavored to do their utmost with the crude means at hand, but were unable to provide proper sanitary appliances to aid them. Those of class 3 had neither good equipment nor good intentions, ignorance and indifference combining to produce an unwholesome product. As a result of the publication of the results from year to year, "no less than a dozen unworthy dairymen have found their business unprofitable. In addition to this several dairies have undergone a complete change in construction and in methods of production, and the supply as a whole has been raised to a high standard of purity."

Turbine Babcock testers, the cause of some incorrect tests, F. W. WOLL (*Hoard's Dairyman, 31 (1900), No. 4, pp. 74, 75*).—Chemical analysis of samples of milk preserved with potassium bichromate gave results uniformly from 0.1 to 0.3 per cent lower than the Babcock test. An investigation was made of the cause of this variation. The fat extraction was continued in some cases for 18 hours without bringing the results up to those obtained by the Babcock test. The error was then looked for in the steam turbine tester used. A comparison of chemical analysis and hand testers gave practically the same results, while tests of the same milks in nearly all of a number of turbine testers were higher. Bottles which had given results in hand testers agreeing with chemical analysis were placed in turbine testers and whirled for a few minutes, the effect being to increase the reading from 0.1 to 0.2. With rich milk and cream the disagreement was still more marked.

The high results with the turbine testers are considered as fully explained by the expansion of the fat at the high temperatures at which readings are taken. The temperature in the tester was often found to reach 200° F. In the use of such testers it is recommended that before readings are taken the fat be allowed to cool to 140° F. by placing the bottles in water of that temperature, or by leaving the cover off the machine for a few minutes. The only advantage of a very high temperature, as stated, is that the readings may be postponed a little longer. The following disadvantages are pointed out:

"The readings [at high temperatures] are never perfectly clear and distinct, there being always more or less black flocculent matter in or directly below the fat column, or foam on top of it; the bottles are very hot and therefore difficult to handle as taken out of the tester, and owing to the rapid cooling of the bottles when taken out the fat column will sink perceptibly in the neck of the bottles, thus rendering the reading more uncertain."

Dairying, J. FIELDS (*Oklahoma Sta. Rpt. 1899, pp. 81–84*).—Popular notes based on previous publications of the station are given on making butter, feeding dairy cows, and establishing creameries.

Breeding and care of cows, A. SCHMID (*Molk. Ztg., 14 (1900), Nos. 9, pp. 133, 134; 10, pp. 149, 150*).—Various phases of the subject are discussed and variations in the food constitutents of crops grown on different soils and under varying conditions are noted.

Cost of wintering the beef herd, E. R. LLOYD (*Mississippi Sta. Bul. 60, pp. 23–25*).—Data are given relative to the cost of feeding a herd of 25 cows and 1 bull from November 25, 1898, to March 15, 1899. The daily ration consisted of 3¾ lbs. of cotton-seed meal and 9¾ lbs. of cotton-seed hulls, in addition to mixed hay. The cost of feed was $152.92 and labor $8.10. The manure was valued at $87.63, leaving a net cost of $73.39 for the feed and care of the herd for 135 days. Omitting 2 cows, the herd made an average gain from January 10 to February 10 of 12.7 lbs., and from February 10 to March 17 of 2 lbs.

Palm-nut cake and cocoanut cake as feeding stuffs for milch cows, TANCRÉ (*Landw. Wchnbl. Schleswig-Holstein, 50 (1900), No. 9, pp. 145–148*).—The author discusses the character, composition, and relative feeding value and cost of palm-nut cake and cocoanut cake, noting briefly the results of several experiments. Palm-nut cake is considered an excellent feeding stuff for milch cows when fed not to exceed 4 lbs. daily. At that rate it increases the fat content of the milk and gives the butter a pleasant flavor. When fed in larger quantities the butter becomes hard and tallowy. It is thought especially suited to feeding with roots. Cocoanut cake gives similar results except that its influence upon the hardness of the butter is not so marked.

Milk averages, G. D. MACDOUGALD (*Abs. in British Med. Jour., 1900, No. 2055, p. 1248*).—The author, who is the public analyst for Dundee, has published some curves showing the variations in the monthly average composition of 12,069 samples of milk examined from July, 1897, to February, 1900. The average for all the samples was 12.50 per cent of total solids, 3.82 of fat, and 8.68 of solids-not-fat. The curves show little regularity in the variation for different months, except that in the months of August and September the solids-not-fat were generally very low.

Variations in the quality of milk, P. DECHAMBRE (*Ind. Lait., 25 (1900), No. 12, pp. 89, 90*).—Differences in the composition of the first and last milk drawn and variations due to gestation, spaying, individuality, breed, etc., are briefly discussed.

Influence of micro-organisms on milk, DUCLAUX (*Ind. Lait., 25 (1900), No. 9, pp. 65, 66*).—The action of certain micro-organisms on the casein of milk is discussed. In one experiment aerobic bacteria increased the soluble casein in the milk from 0.4 to 1.89 per cent. *Tyrothrix tenuis* in milk containing 3.90 per cent of casein rendered 2.57 per cent soluble. In another experiment all the casein in milk which had been subjected to the prolonged action of fungi passed through a porcelain filter.

Testing skim milk, E. H. FARRINGTON (*Hoard's Dairyman, 31 (1900), No. 15, p. 295*).—In testing skim milk by the Babcock method, high speed and a high temperature are considered essential for the best results. A temperature of 200° F. is not thought too high.

Milk production and distribution from the standpoint of public health, J. TEDDIE (*Veterinarian, 73 (1900), No. 865, pp. 26–36*).—A general discussion of the question, with recommendation of systematic inspection of dairy cows, application of tuberculin test, and exclusion of reacting animals.

The manufacture of butter in Canada, G. APPRY (*Ind. Lait., 25 (1900), No. 16, pp. 121, 122*).—Brief popular notes on methods.

Seasonable notes on cheese making, J. A. RUDDICK (*New Zealand Dept. Agr., Dairying Service Leaflet, 1900, No. 14, pp. 3*).—Brief notes on salting and pressing and on defects in cheese due to faulty methods of manufacture.

Faults in manufacture and diseases of cheese, A. POURRIAU (*Ind. Lait., 25 (1900), No. 17, pp. 129, 130*).—Defects in cheese are noted as resulting from the use of tainted milk or from unfavorable conditions during the process of manufacture, and means of prevention are briefly discussed.

Effect of temperature in curing cheese, R. W. STRATTON (*Amer. Cheesemaker, 15 (1900), No. 169, p. 6*).—In experiments conducted at the Ontario Agricultural College in 1899, cheeses from the same curd were cured in three rooms. The temperature of room 1 was kept at 60° by the use of ice. The temperature of room 2 was controlled by subearth ducts and averaged 65°. No control was used in room 3, which had an average temperature during the season of over 69°. The average percentage of shrinkage for 4 weeks of cheese in room 1 was 2.79; in room 2, 3.14, and in room 3, 4.14 per cent. The cheese cured at the lower temperature was decidedly superior in flavor and texture.

Faults of Gruyère cheese, C. MARTIN (*Ind. Lait., 25 (1900), No. 11, pp. 81, 82*).—A fault of this cheese, designated "lainage" and characterized by cracks in the cheese, is described and means of avoiding it are indicated.

The manufacture of condensed milk, HITTCHER (*Molk. Ztg., 14 (1900), No. 7, pp. 98–100; Milch. Ztg., 29 (1900), No. 9, pp. 132–134*).—An historical and descriptive account of the manufacture of condensed milk.

German laws relating to margarin, G. FULL and M. REUTER (*Die deutscher Margarinegesetzgebung, nach dem Reichsgesetz betreffend den Verkehr mit Butter, Käse, Schmalz und deren Ersatzmitteln vom 15 Juni 1897. Berlin: Paul Parey, 1899, pp. 156*).—Laws of some of the States of Germany relative to the manufacture and sale of butter, cheese, lard, and their substitutes, with detailed technical directions for the analysis and testing of each.

VETERINARY SCIENCE AND PRACTICE.

Report of the bacteriologist, C. E. MARSHALL (*Michigan Sta. Rpt. 1898, pp. 135–138*).—This report covers the subjects of tuberculosis, crown gall in peaches, gassy cheese, suspected hog cholera, and cleanliness in milking.

Studies upon the determination of normal temperatures of cattle have been continued. The station has not so far detected any infectiousness in milk taken from cows condemned for tuberculosis, although numerous tests have been made. Studies are being prosecuted to determine the possibility of infection by urine and feces from tuberculous animals, as well as along lines of curative treatment and eradication of tuberculosis from the college herd.

An attempt is being made to discover the cause of crown gall in peaches, and this matter is being studied at Bangor, Mich., where the disease prevails to a considerable extent.

The organism which causes gas production in cheese has been isolated, and further studies will be made upon it.

In an outbreak of supposed hog cholera on the college farm, as well as in similar outbreaks in other parts of the State, it was found impossible to isolate the hog-cholera germ. These outbreaks are believed to be due to local conditions of climate and food.

A study is being made of the effect upon milk of greater cleanliness in the process of milking.

Report of the director of the stock institute, C. J. POUND (*Queensland Dept. Agr. Rpt. 1898–99, pp. 96–115*).—A brief report is made on the work of the institute in furnishing virus for protective inoculation against pleuro-pneumonia. Numerous experiments were conducted in producing immunity against Texas fever. At the Indooroopilly Experiment Station 38 immune steers and heifers are kept for the purpose of furnishing blood for inoculation. Records are kept as to the amount of blood drawn from each animal. In some inoculation experiments a considerable loss was experienced, and the cause of this loss is discussed by the author. A few cases of temporary insusceptibility to Texas fever were found, and in several instances more than one inoculation was necessary. The question of a possible hereditary immunity was studied by means of the following experiment: Three pregnant heifers inoculated at the same time showed a pronounced temperature reaction, but later recovered completely. When the calves from these heifers became yearlings they were inoculated with the blood of recovered animals. All of them developed high fever temperatures. This evidence indicates that immunity to Texas fever is not inherited.

Observations were made for the purpose of determining the duration of immunity, and the results obtained indicate that the duration varies from 1 to 2½ years. It is found that virulent blood from animals in a high state of fever produces serious consequences when injected into healthy animals. Numerous experiments were conducted in reference to dips and dipping methods. The author states that he has found no dipping method which is certain to destroy the ticks in all stages of their existence which does not at the same time affect the animals unfavorably. The use of arsenic in the destruction of ticks is discouraged.

Observations were made on the effects of low temperatures on ticks, during which 300 fully developed female ticks were placed in a glass capsule and kept at a temperature of 29° F. Every 24 hours 40 ticks were removed and kept in the temperature of the room. All ticks which were removed before the fifth day remained alive and laid the usual number of eggs. After 6 days' freezing a number were found dead, and all were destroyed by 7 days' freezing. The entire progeny of 5 ticks, numbering 10,000 larvæ, were placed in a tube and kept at the same temperature as in the previous experiment. All of the larvæ remained alive until the third day. On the fourth about half of them were dead and by the sixth day all had perished.

The author gives a report of investigations of tuberculosis, with notes on the disease in pigs, sheep, goats, and birds. A brief account is given of the results obtained by the tuberculin test, and the author discusses the problem of heredity and acquired susceptibility to tuberculosis.

Brief notes are given on blackleg and on the use of the bacillus of chicken cholera in destroying rabbits and of the bacillus of mouse typhus in the destruction of mice.

Appended to this report an account is given of investigations carried out by J. S. Hunt, Government pathologist. These investigations include experiments to determine how ticks acquire their virulence. The results of these experiments indicate that nonvirulent ticks do not become infected with the organism of Texas fever from the soil, but that the infection of the ticks is always due to their living upon diseased cattle. A brief account is given of the effects of a large number of ticks upon cattle in producing so-called "tick worry." Further experiments were conducted on the question of inherited immunity against Texas fever. The calves of recovered cows gave a high fever reaction when inoculated with the blood of recovered animals, thus furnishing further evidence that immunity is not inherited.

A further investigation was made upon the cause of rickets, and the author concludes that this disease is produced by eating species of Macrozamia.

Annual report of the Board of Cattle Commissioners of Massachusetts, A. PETERS ET AL (*Rpt. Bd. Cattle Com. Massachusetts, 1899, pp. 98*).—This report contains an account of tuberculosis, glanders, rabies, symptomatic anthrax, actinomycosis, infectious mammitis, and swine diseases occurring in the State of Massachusetts. Notes are given on various features of the quarantine and other regulations of the board.

In regard to tuberculosis the authors make the following recommendations: The maintenance of a quarantine against diseased cattle from adjoining States, the annual inspection by local inspectors of the animals in the State, and the testing of entire herds so far as the funds of the board of commissioners will allow.

It is reported that glanders has been unusually prevalent in the State during the past year. Detailed notes are given on the number of suspected horses which have been tested and the number destroyed. Several outbreaks of rabies occurred in different parts of the State during the year. There was an outbreak of symptomatic anthrax in Ashburnham. The legislature added actinomycosis to the list of contagious diseases, and under the law the cattle commission is empowered to kill animals which are suffering from this disease without appraisal or the payment of indemnity. Two cases are reported of actinomycosis in the mammary gland, which were mistaken for tuberculosis until a microscopic examination was made. A few cases of hog cholera were noted, and one supposed outbreak of hog cholera was found to be due to feeding swill from hotels.

Abortion, W. T. LAWRENCE (*County Councils Cumberland, Durham, and Northumberland, Tech. Education, Rpt. 7 (1898), p. 76*).—This disease being somewhat prevalent on the experimental farm, pregnant cows were treated with internal doses of carbolic acid from March 15 to May 20. The daily dose was $\frac{1}{8}$ oz. of carbolic acid mixed with a dessert-spoonful of glycerin and water and fed with moistened bran. Three out of the eight cows thus treated aborted. On June 18 the stables were whitewashed with hot lime and carbolic acid and the floors treated with a strong solution of copper sulphate. On August 9 was begun a treatment of the hind quarters of each pregnant cow with Nocard's solution, and this was continued for two months. Three out of seven cows thus treated aborted.

Another experiment was tried during which the aborted calf and afterbirth were carefully removed, the hind quarters of the cow washed with Nocard's solution, and a quantity of the solution was thrown on the floor around the cow. This process was continued for three months or as long as any discharge continued to appear. Two cows which aborted in one stable, and one in another stable, were treated in this way and no case of abortion has since occurred.

Contribution to the knowledge of actinomycosis, J. BRAULT (*Arch. Parasit., 2 (1899), No. 4, pp. 535–547, figs. 6*).—A case of human actinomycosis, which developed in extensive ulcerations of the arm, is described and illustrated. The ordinary iodin treatment was given, the doses being gradually increased. At the end of 8 weeks, the dose had reached the size of 4 gm. per day. At the beginning of the treatment local injections of iodid of silver were used.

From bacteriological material obtained in this case, the author made numerous cultures, and notes are given upon the behavior of the organism when grown on different culture media. Inoculations were made with pure cultures in the skin, pleura, tongue, and gums of rats, guinea pigs, and rabbits. One guinea pig, which was inoculated in the pleura, died after 8 days. In all the other cases the animals survived and showed no pathological symptoms, although they were carefully reserved for several months. Two cases of intraperitoneal inoculations are recorded in detail. The one case was in a rabbit, the other in a guinea pig. After a period of three months, these animals died with symptoms of general peritonitis. In both cases until within a few days before death, no symptoms of disease could be noticed. Careful *post-mortem* examinations were made on both these animals and all the symptoms of peritonitis were present. The organism in question was found to be present in the purulent material.

Report on an investigation with regard to the value of tuberculin as a test of the presence of tuberculosis in cattle, J. M. YOUNG and J. S. H. WALKER (*Univ. of Aberdeen Dept. Agr., 1899, pp. 18*).—In this article the authors report the results obtained by the use of the tuberculin test upon 240 cattle and a subsequent *post-mortem* examination of all these animals. The animals upon which these observations were made were killed for market use and the authors obtained permission to apply the tuberculin test before they were slaughtered and to conduct a *post-mortem* examination in each case. The *post-mortem* examinations presented clear evidence of tuberculosis in every animal which had reacted to the tuberculin test. It was found also that a considerable number were tuberculous which had not reacted to the tuberculin test. These cases were either in the very earliest stages or in rather advanced stages of tuberculosis. Thirty one and seven-tenths per cent of all animals examined were found to be tuberculous. It was found in this study that tuberculin loses its virulence when kept for any great length of time.

A number of the animals upon which observations were made were heifers two years of age. Of the heifers 16.6 per cent were tuberculous while 54.5 per cent of the cows were tuberculous. The cows were of an average age of 7½ years. Almost 10 per cent of the cows had tuberculous udders and 16 per cent of the tuberculous cows had tuberculosis of the udder. The authors concluded that tuberculosis of the udder occurs more frequently than is generally supposed.

The diagnosis of glanders, A. DEDYULIN (*Arch. Vet. Nauk, St. Petersburg, 29* (*1899*), *No. 12, II, pp. 565–570*).—Brief notes are given on the reliability of the inoculation of guinea pigs, of the examination of the submaxillary glands, the inoculation of cats, and the use of mallein in the diagnosis of glanders. It has been asserted that the blood of glanderous horses always contains the glanders bacillus in the plasma or blood corpuscles, or both.

In order to test this method for diagnosing glanders, the author made a bacteriological investigation of the blood of 15 horses which were suffering from various forms of glanders. All these horses undoubtedly had glanders as was evidenced by clinical symptoms and by reaction to mallein. Some of the horses had been tested with mallein at 4 different times and had reacted on each occasion. Glanders bacillus was not found in the blood. Two of the horses seemed to be more interesting cases than the others, and the author gives a detailed account of the study of the blood from these 2 cases. The first one was a 12-year-old trotting horse with no clinical symptoms of glanders, with a good appetite and good general appearance. The horse had been under observation for 3 years. There had been a nasal discharge, but this had ceased. Mallein injections had been given at 4 different times, and a decided reaction had been manifested each time. A detailed record of the temperature of this and the other case is given. The second case was a large work horse 8 years of age with a pronounced nasal form of glanders.

The statement has been made in connection with the assertion that the glanders bacillus is found in the blood of glanderous horses, that the number of bacilli is much increased during the temperature reaction to the mallein test. In the case of both these horses, therefore, the author examined the blood from the jugular vein at other times and also at the height of the temperature reaction. It was not only subjected to bacteriological examination, but various culture media and also cats were inoculated. No evidence was obtained of glanders bacillus in the blood. The culture media remained sterile and the cats, although kept under observation for 30 days, did not develop cases of glanders.

Disease among horses, L. L. LEWIS (*Oklahoma Sta. Rpt. 1899, pp. 39, 40*).—A disease which was especially prevalent among horses in the western portion of Oklahoma was found to be confined to horses which were feeding upon grama grass (*Bouteloua oligostachya*) in pastures. The seeds of this grass were largely replaced by smut (*Ustilago bouteloua*). Horses which were not allowed to feed in pastures were not affected by the disease. As remedies the author used potassium bromid, chloral, atropine, and cold packs upon the head, as the case required. Most of the cases, however, ran a short course and were incurable. The symptoms and conditions found upon *post-mortem* indicated an inflammation of the brain, bloody serum being found upon the cerebral membranes.

Treatment of diseases by light (*U. S. Consular Rpts., 62 (1900), No. 233, pp. 191 192*).—A brief report on the Finsen Light Institute in Copenhagen and upon the effectiveness of light rays in the destruction of micro-organisms.

Notes on the inoculation of horses for the preparation of antiplague serum, S. N. RANINA (*Veterinarian, 73 (1900), No. 866, pp. 75–81*).—A discussion of the technique of this method, together with notes on experiments with a number of horses. A bibliography of the subject is added to the article.

A short course in special pathology and therapeutics of the internal diseases of the domestic animals, K. M. HOLTZMAN (*Kratkii Kurs chastnoi patologii terapii vnutrennikh bolyeznei domashnikh zhivotnuikh. Kazan, 1900, 2. ed., pt. 1, pp. 97, figs. 13*).—Nine lectures on the various diseases of the heart and blood vessels.

Œstridæ, and their economic importance, A. BERGMAN (*Svensk. Vet. Tidskr., 4 (1899), No. 10, pp. 433–446*).—Biological and economic notes on species of Hypoderma and Gastrophilus affecting domestic animals.

Actinomycosis, D. WULFF (*Berl. Tierärztl. Wchnschr. (1900), No. 2, pp. 13–17*).—A study of the relative frequency of infection by various channels, such as the mouth, respiratory apparatus, alimentary tract, and skin, together with an account of the frequency of the infection of man with actinomycosis and the necessity of meat inspection.

Contagious agalactia, T. MAZHDRAKOV (*Vet. Sbirka, 8 (1899), No. 2, pp. 25-27*).

A comparative study of antianthrax substances in the dog and rabbit, O. BAIL (*Centbl. Bakt. u. Par., 1. Abt., 27 (1900), No. 1, pp. 10-21*).—The author carried on a number of experiments during which it was shown that the behavior of the anthrax bacillus toward cells and sera of the susceptible rabbit differed in a striking manner from its behavior toward the same materials from the more resistant organism of the dog. It would appear from these experiments that the relationship between anthrax bacillus and antipathetic substances is not so simple as has been assumed, and probably the theories of Metschnikoff, Baumgarten, and Buchner can not be maintained without considerable qualification.

Emphysematous anthrax, Z. G. PUKHALSKI (*Arch. Vet. Nauk, St. Petersburg, 29 (1899), No. 12, II, pp. 583-589*).—The author's observations on this disease were begun in 1890. The course of the disease is always uniform. The attack is sudden with development of high fever, swellings on various parts of the body, difficult locomotion, lameness, a fall of the temperature, collapse, and death within 3 days from the beginning of the attack.

A bacteriological study was made of material taken from the swellings. The author believes, as a result of these investigations, that this disease is distinct from ordinary anthrax.

Bovine distemper, C. MCCULLOCH (*Virginia Sta. Bul. 95, pp. 145-151*).—This bulletin contains brief notes on the history, etiology, symptoms, course, pathology, prognosis, and treatment of bovine distemper.

Contagious keratitis, P. BICHEV (*Vet. Sbirka, 7 (1898), No. 10, pp. 227-229*).—A solution of potassic permanganate, 1 to 2 per cent, was found effective as a wash.

Further investigations into the etiology of pleuro-pneumonia, NOCARD ET AL (*Veterinarian, 73 (1900), No. 865, pp. 36-43*).—Experimental investigations with preventive inoculation against this disease.

Rabies in cattle, W. EDDY (*Jour. Comp. Med. and Vet. Arch., 20 (1899), No. 12, pp. 787-790*).—A study of an outbreak of rabies which was traced to the bites of a rabid dog.

Texas fever (*Oklahoma Sta. Rpt. 1899, pp. 74, 75*).—A brief restatement of some of the results which were published in Bulletin 39 of the station (E. S. R., 11, p. 391).

Veterinary work, L. A. MERRILL (*Utah Sta. Rpt. 1899, pp. 29-36, figs. 2*).—Brief notes on the tuberculin test, together with a general account of the use of blackleg vaccine and practical directions for preparing and applying it.

The thermal death point of the tubercle bacilli in milk and some other fluids, T. SMITH (*Jour. Expt. Med., 4 (1899), No. 2, pp. 217-233*).—In these experiments tubercular material of human and bovine origin was used. The results may be stated as follows: The tubercle bacillus in suspension in distilled water, normal salt solution, or bouillon and milk, is destroyed at a temperature of 60° C. in from 15 to 20 minutes. When the tubercle bacillus is suspended in milk, the pellicle which forms during the exposure at 60° C. may contain live bacilli after one hour.

Some measures lessening the infection and spread of tuberculosis, S. C. JONES (*Jour. Tuberculosis, 2 (1900), No. 1, pp. 1-5*).—Recommends the careful inspection of dairy cattle and milk.

Differential clinical diagnosis of pulmonary emphysema with chronic bronchitis and of pulmonary tuberculosis of the second stage in cattle, G. MOUSSU (*Rec. Med. Vet. Paris, 8. ser., 7 (1900), No. 1, pp. 5-12*).—A study of the symptoms by means of which the two diseases may be distinguished.

Differential diagnosis between tuberculosis and swine plague, S. NYSTEDT (*Svensk. Vet. Tidskr., 4 (1899), Nos. 9, pp. 393-403; 10, pp. 430-433*).—The author discusses in a critical manner the literature of this subject and gives in detail the clinical symptoms and *post-mortem* findings in a number of cases of tuberculosis and swine plague in hogs.

Post-mortem of tuberculous guinea pigs (*Agr. Student, 6 (1899), No. 1, p. 10*).—Notes on the *post-mortem* findings in guinea pigs which had been inoculated with material from old encapsuled abscesses of tuberculous cattle.

New treatment for tuberculosis, W. P. ATWELL (*U. S. Consular Rpts., 63 (1900), No. 232, pp. 31–34*).—A brief account of Dr. Mendel's treatment for tuberculosis, which consists in the use of tracheal injections of a solution composed of essence of thyme, essence of eucalyptus, essence of cinnamon, sterilized olive oil, and iodoform.

Prevention of bovine tuberculosis, E. NOCARD (*Rec. Med. Vet. Paris, 8. ser., 7 (1900), No. 1, pp. 21–32*).—A detailed record of numerous tuberculin tests.

Report of the Board of Sheep Commissioners of Montana for 1899, T. C. POWER and C. HEDGES (*Helena, 1900, pp. 23*).—This report contains a statistical statement showing the condition of the sheep in different parts of the State, a statement of the rules for the guidance of deputy sheep inspectors, a copy of the quarantine proclamation regarding sheep scab, and a report by the State veterinarian on foot rot, sheep pox, and tapeworm.

Diarrhea in young pigs, P. V. KREDBA (*České Listy Hospodarské, 7 (1899), No. 8, pp. 293, 294*).—An account of the etiology of the disease, with suggestion of remedies.

Reappearance of glanders after recovery, NOCARD (*Rec. Med. Vet. Paris, 8. ser., 6 (1899), No. 24, pp. 502–508*).—An attack of glanders followed by recovery does not confer immunity to the disease.

State control of glanders in Minnesota, M. H. REYNOLDS (*Jour. Comp. Med. and Vet. Arch., 20 (1899), No. 12, pp. 737–742*).—A statement of the rules of the Minnesota State Board of Health regarding glanders, and a general discussion of the problem involved in the study and control of this disease.

The diagnostic value of argentum Credé in glanders, RODER (*Deut. Tierärztl. Wchnschr., 7 (1899), No. 47, pp. 417–419*).—From a number of experiments with intravenous injections of argentum colloidale, the author concludes that this substance causes a temperature reaction in glanderous horses and also in horses which are suffering from other internal diseases. The use of the Credé silver preparation, however, renders the final diagnosis more easy and certain. A reaction of 2° C. was manifested within 6 hours after injection with the silver preparation.

The reliability of the Strauss method, M. PRETTNER (*Centbl. Bakt. u. Par., 1. Abt., 26 (1899), No. 18–19, pp. 563, 564*).—In experiments conducted by the author it was found that the Strauss method for diagnosing glanders from inoculation of guinea pigs with suspected glanderous material was uniformly reliable.

Contagious pleuro-pneumonia of the horse, CADIOT (*Rec. Méd. Vét. Paris, 8. ser., 6 (1899), No. 20, pp. 361–372*).—The author reports a study of this disease by the military veterinarian, Bourgès, who has studied an outbreak of pneumonia which persisted for 7 months. Young horses were much more frequently attacked than older ones, and horses at the age of 5 enjoyed a complete immunity. One attack of the disease confers immunity of long duration.

Antitoxin in the bile of rabid animals, J. LEBELL (*Centbl. Bakt. u. Par., 1. Abt., 26 (1899), No. 20–21, pp. 635–639*).—The results of the author's experiments may be briefly summarized as follows: The bile of rabid animals regularly produced an attenuation of rabies in experimental rabbits. In some cases the rabies virus and rabid bile were mixed before inoculation; in others the rabid bile was injected after inoculation with the virus. The bile of healthy rabbits had no effect in retarding the progress of rabies.

Rabies inoculations for diagnostic purposes, JOHNE (*Ztschr. Tiermed., 2 (1898), No. 5, pp. 349–371*).—Experimental studies in connection with the diagnosis of rabies. Inoculation is considered the only reliable method.

Chicken cholera, W. EBER (*Ztschr. Tiermed., 2 (1898), No 2, pp. 120–124*).—A discussion of the symptoms of the disease.

Canadian chicken cholera, C. H. HIGGINS (*Jour. Comp. Med. and Vet. Arch., 20 (1899), No. 10, pp. 605–611*).—The author investigated an outbreak of a disease among chickens in Montreal. The symptoms and *post-mortem* findings were in general very similar to those of ordinary chicken cholera. The pathogenic organism was isolated and cultures were made upon several nutrient media. The organism seems to be identical with that of European chicken cholera, but different from the one which is already recognized in America. The author enumerates the differences in the biological and pathological characters of the organisms.

The influence of a preliminary exposure to ammonia vapor upon the incubation of hens' eggs, C. FÉRÉ (*Compt. Rend. Soc. Biol., 11. ser., 1 (1899), No. 30, pp. 806–808*).—A number of experiments were conducted to show the effect of ammonia vapor upon the development of hens' eggs. After such an exposure for several hours it was found that the eggs underwent no development. Upon an examination these eggs presented abnormal conditions. The embryonic area no longer maintained its position on the upper surface of the yolk, but had lost its physical properties and was indifferent.

AGRICULTURAL ENGINEERING.

Irrigation in the Rocky Mountain States, J. C. ULRICH (*U. S. Dept. Agr., Office of Experiment Stations Bul. 73, pp. 64, pls. 10*).—"This bulletin is intended to explain the agricultural conditions prevailing and the methods of acquiring and using water for irrigation practiced in that portion of the arid region covered more particularly by the States of Colorado, Wyoming, Utah, Idaho, and Montana, in which the conditions and methods are somewhat similar. . . . The subject is treated in an elementary manner."

The bulletin discusses the following topics: General characteristics of the Rocky Mountain States; how canals and ditches have been built; operation of canals; methods of applying water to the land; character of supply and use of water; how water rights are acquired and maintained; contracts between corporations and irrigators, and cost and conditions of reclamation of land in the arid region. An appendix briefly describes methods of water administration in the Rocky Mountain States, with lists of irrigation officials.

Sewage irrigation, G. W. RAFTER (*Water Supply and Irrig. Papers, U. S. Geol. Survey, No. 22, pp. 100, pls. 7, figs. 4*).—This is a continuation of paper No. 3 of this series (E. S. R., 9, p. 393). The first paper dealt with the general subject of sewage irrigation and gave the practice abroad. The present paper "is devoted mainly to the discussion of data obtained in this country and in Canada, and of all the plants erected and operated, together with brief notes on the projected plants. There is included an appendix containing a list of publications relating to the subject."

"In the humid region there are sewage-purification plants in operation, actually building, projected, or built and abandoned, distributed by States as follows: Maine, 1; New Hampshire, 2; Massachusetts, 32; Rhode Island, 5; Connecticut, 7; New York, 33; New Jersey, 11; Pennsylvania, 5; Maryland, 1; West Virginia, 1; Louisiana, 1; Texas, 3; Ohio, 11; Michigan, 2; Illinois, 2; Wisconsin, 2; Minnesota, 1; a total of 120 for the humid region. In the subhumid there is 1 in Nebraska. In the arid region Arizona has 1; Colorado, 4; California, 8; Montana, 1; Utah, 1; Wyoming, 1, or a total of 16. There are also 6 plants in the humid portion of the Dominion of Canada.

"The foregoing figures indicate a total for the United States and Canada of 143. About 120 of these plants have been either built or projected in the last ten or twelve years. This total includes, so far as can be learned, all the purification plants of every kind, whether irrigation, intermittent filtration, or combined chemical-purification and filtration and irrigation plants, either actually in operation now or formally projected and in such a state of advancement as probably to be carried out in a few years.[1]

"The intermittent-filtration plants are properly included in a paper on sewage irrigation, because the filtration areas either now are used for raising crops or are likely in the end to be so used. As to the propriety of including the chemical-purification plants, it may be pointed out that this system of purification has been adopted in several towns before all the controlling conditions were taken into account. In one case an eastern town has adopted chemical purification and operated the plant at large expense, in spite of the existence of ideal conditions for irrigation and filtration in the immediate vicinity. It is probable, therefore, that, as soon as the advantages of irrigation and filtration are more fully known, a number of the chemical-purification plants will be changed to either irrigation or filtration, or, without a complete change of plant, the effluents from chemical purification works will be further treated by either irrigation or filtration."

Pumping water for irrigating purposes (*Irrig. Age, 14 (1900), No. 6, pp. 200–206*).

Irrigation by means of artesian wells in Australia, L. Breymann (*Deut. Landw. Presse, 27 (1900), No. 13, p. 137*).—A brief statement of the number and extent of artesian irrigation enterprises in this country.

Water resources of the State of New York, G. W. Rafter (*Water Supply and Irrig. Papers, U. S. Geol. Survey, Nos. 24, 25, pp. 200, pls. 25, figs. 7*).—These papers deal with the physical conditions of river systems of New York, particularly the available water supply, floods, and low water of some of the typical streams; and with water-storage projects and the development of water power and waterways.

Wells of Indiana, F. Leverett (*Water Supply and Irrig. Papers, U. S. Geol. Survey, Nos. 21, pp. 82, pls. 2; 26, pp. 64*).—This is a record of data "collected in connection with glacial investigations as noted in the general discussion of the water resources of Indiana and Ohio, published in Part IV of the Eighteenth Annual Report of the Survey on pp. 419–559." No. 21 gives a detailed discussion of the conditions for obtaining wells in northern Indiana, No. 26 deals with wells of southern Indiana.

Operations at river stations, 1898 (*Water Supply and Irrig. Papers, U. S. Geol. Survey, Nos. 27, 28, pp. 200*).—These bulletins give "descriptions of the river stations maintained during 1898 by the United States Geological Survey, together with tables of the average daily height of water, results of measurements of discharge, and rating tables constructed from the latter and applicable in general for the calendar year." For reports of similar data for 1897 see E. S. R., 11, p. 196.

Water-right problems of the Bighorn Mountains, E. Mead (*Water Supply and Irrig. Papers, U. S. Geol. Survey, No. 23, pp. 62, pls. 7, figs. 8*).—"This paper calls particular attention to the complications arising in the distribution of water as a result of the haphazard construction of small irrigation ditches. The problems encountered in this region are typical of those which are to be met in nearly every State of the West, or which will be met in the near future. The difficulties found in the area described are accentuated by the diversion of water from one stream across divides into other natural drainage lines, thus connecting and greatly complicating the water-rights of one individual with those of others."

The draft of broad and narrow tired wagons, H. J. Waters (*Pennsylvania Dept. Agr. Rpt. 1898, pp. 519–532*).—An article based on investigations at the Missouri Station reported elsewhere (E. S. R., 9, p. 997).

The improvement of country roads, W. J Roberts (*Washington Sta. Bul. 39, pp. 33, figs. 22*).—A general discussion of this subject, especially as applied to Washington conditions.

---

[1] These statistics were prepared in September, 1897. There have been a few additions since that date.

Principles of construction and maintenance of country roads, F. H. King (*Wisconsin Sta. Bul. 79, pp. 48, figs. 28*).—A general discussion of this subject as illustrated mainly in the construction of a section of a model road near Menomonee, Wis., under the supervision of a special agent of the Office of Road Inquiry of this Department.

STATISTICS—MISCELLANEOUS.

Eleventh Annual Report of Michigan Station, 1898 (*Michigan Sta. Rpt. 1898, pp. 4, 5, 113–602*).—This includes the organization list of the station; a financial statement for the fiscal year ended June 30, 1898; a report of the director on the publications, personnel, and work of the station; reports of the agriculturist, horticulturist, chemist, bacteriologist, and apiarist noted elsewhere, and reprints of Bulletins 145–160 of the station issued during the year. Following are the subjects of the bulletins: Commercial fertilizers (E. S. R., 9, p. 938); bacteria and the dairy (E. S. R., 9, p. 990); pasteurization of milk (E. S. R., 9, p. 986); strawberries (E. S. R., 9, p. 1053); feeding dairy cows (E. S. R., 9, p. 1081); sugar beets in Michigan in 1897 (E. S. R., 9, p. 1045); raspberries, blackberries, and grapes (E. S. R., 10, p. 48); report of South Haven Substation (E. S. R., 10, p. 49); vegetable tests of 1897 (E. S. R., 10, p. 47); some experiments in corn raising (E. S. R., 10, p. 136); spraying calendar for 1898 (E. S. R., 10, p. 470); legislation relating to insects and diseases of fruit trees, and preliminary report of the State inspector of nurseries and orchards (E. S. R., 10, p. 470); hog cholera (E. S. R., 10, p. 596); some experiments with poultry (E. S. R., 10, p. 580); a study of normal temperature and the tuberculin test (E. S. R., 10, p. 692); some insects of the year 1897 (E. S. R., 10, p. 766).

Annual Report of Missouri Station, 1898 (*Missouri Sta. Rpt. 1898, pp. XV+163*).—This contains the organization list of the station, a financial statement for the fiscal year ended June 30, 1898, a detailed review of station work by the director, miscellaneous articles noted elsewhere, list of college and station bulletins, and reprints of Bulletins 40–43 of the station on the following subjects: The sugar beet (E. S. R., 9, p. 944), the San José scale in Missouri (E. S. R., 10, p. 566), the fringed-winged apple-bud moth (E. S. R., 10, p. 564), winter forcing of asparagus in the open field (E. S. R., 10, p. 548).

Fifth Annual Report of Montana Station, 1898 (*Montana Sta. Bul. 20, pp. 91–124*).—This contains the organization list of the station and reports of the treasurer, director, horticulturist, botanist, biologist, chemist, and agriculturist, parts of which are noted elsewhere. Included in the several reports are brief notes on farm improvements, the new greenhouse and steam-heating plant, farmers' institutes, and on plat experiments; lists of exchanges and of bulletins issued; and brief summaries of results obtained during the year.

Biennial Report of North Carolina Station, 1897 and 1898 (*North Carolina Sta. Rpt. 1897 and 1898, pp. 78*).—This covers the work of the station for the two years ended December 31, 1898, and includes a discussion of the relation of the station to the State and National Government, an outline of the history and the organization list of the station, a summary of the publications issued during 1897 and 1898, a brief review of the different lines of station work, and a list of acknowledgments. Departmental reports giving a more detailed account of work in agriculture, chemistry, horticulture, botany, entomology, veterinary science, and fertilizer control are appended.

Twenty-second Annual Report of North Carolina Station, 1899 (*North Carolina Sta. Rpt. 1899, pp. LII+462*).—This is in part reprinted with changes from the Biennial Report of the Station for 1897 and 1898, noted above. It includes in addition the text of the Hatch Act, a summary of publications issued during the year, a financial statement for the fiscal year ended June 30, 1899, and reprints of Bulletins 152–169 of the station on the following subjects: Poultry notes (E. S. R., 10, p. 1087), vinegar adulteration and the extent to which it exists in the samples for sale in North

Carolina (E. S. R., 10, p. 1077), the adulteration of coffee and tea (E. S. R., 10, p. [illegible]), baking powders on sale in North Carolina (E. S. R., 11, p. 278), the adulteration of flour (E. S. R., 11, p. 278), mineraline (E. S. R., 11, p. 278), the fertilizer control for 1896 (E. S. R., 11, p. 229), horticultural experiments at Southern Pines, 1896 (E. S. R., 11, p. 341), digestion experiments (E. S. R., 11, p. 276), drinking water (E. S. R., 11, p. 326), farming in North Carolina (E. S. R., 11, p. 497), rational stock feeding (E. S. R., 11, p. 483), the flora of North Carolina (E. S. R., 11, p. 909), preservatives in canned foods offered for sale in North Carolina (E. S. R., 11, p. 960), butter (E. S. R., 11, p. 984), poultry experiments (see p. 1073), field and forage experiments (see p. 1032), feeding experiments and milk records (see p. 1078).

Annual Report of Oklahoma Station, 1899 (*Oklahoma Sta. Rpt. 1899, pp. 7-96*).—The director's report gives the organization list of the station and reviews the different lines of station work during the year. A financial statement for the fiscal year ended June 30, 1899, and a subject list of station bulletins are given. The report also contains several articles, abstracts of which are given elsewhere, and an extended summary of the results of the more important work done since the establishment of the station.

Annual Report of South Carolina Station, 1898 (*South Carolina Sta. Rpt. 1898, pp. 37*).—This includes the organization list of the station, a financial statement for the fiscal year ended June 30, 1898, a brief report by the vice-director, lists of acknowledgments and station publications, and departmental reports reviewing the different lines of investigation and giving an account of work noted elsewhere.

Eleventh Annual Report of Texas Station, 1899 (*Texas Sta. Rpt. 1899, pp. 55-90*).—The director's report contains a review of station publications issued during the year, and a discussion of farmers' organizations, the organization and equipment of the station, distribution of station funds, and the general work of the station. Resolutions of the Texas Farmers' Congress and the Texas Live Stock Association relating to the needs and work of the stations and substations are given. Reports of the chemist, veterinarian, horticulturist, and agriculturist outline the work in their respective departments. The report of the agriculturist contains in addition conclusions from experiments with corn, reprinted from Bulletin 49 of the station (E. S. R., 11, p. 233). The organization list of the station, a financial statement for the fiscal year ended June 30, 1899, and a subject list of station publications are also included in the report.

Tenth Annual Report of Utah Station, 1899 (*Utah Sta. Rpt. 1899, pp. XLV, pls. 2, fig. 1*).—This contains a report of the director, on the staff, buildings and equipment, publications, and lines of investigation; a subject list of all the bulletins issued by the station; departmental reports reviewing at some length the different lines of station work, and noting briefly methods and results in some cases; a financial statement for the fiscal year ended June 30, 1899; list of periodicals received by the station library; and an index to the report and the bulletins published during the year.

Ninth Annual Report of Wyoming Station, 1899 (*Wyoming Sta. Rpt. 1899, pp. 41-65*).—These pages include notes on the origin and purpose of the station, a brief summary of bulletins issued during the year, an outline plan of station work, a financial statement for the fiscal year ended June 30, 1899, and reports of the director, agriculturist and horticulturist, botanist, chemist, geologist, and meteorologist and physicist reviewing the different lines of station work. Several articles noted elsewhere and reprints of Bulletins 38-40 of the station and Index Bulletin B are appended to the report proper. Bulletin B is an index to Bulletins 27-37 of the station, and Bulletins 38-40 deal with the following subjects: Cultivated shade and forest trees (E. S. R., 10, p. 965), alkali studies, II (E. S. R., 10, p. 1025), the trees of Wyoming and how to know them (E. S. R., 11, p. 53).

NOTES.

California University and Station.—A. P. Hayne, viticulturist of the station, has resigned and accepted a position with a commercial company in Manila. Le Roy Anderson, of Cornell University, has been appointed assistant in charge of dairy husbandry. Carrol Fowler, a graduate of the university, will have charge of the entomological work during the present year, C. W. Woodworth having been granted a year's leave of absence. S. N. Andrews, of Pomona, has been appointed patron of the Southern California Substation in place of C. F. Loop, deceased. A. W. Foster, president of the California Northwestern Railroad, has been made a regent of the university in place of A. S. Hallidie, deceased.

Illinois University and Station.—P. G. Holden, agronomist in the university and station, has resigned to accept a position as field agriculturist for a sugar refining company at Pekin, Ill. C. G Hopkins, chemist to the station, will also have charge of the work of Professor Holden. Professor Hopkins has been spending the past year in study and travel in Europe, but will return in September. W. J. Fraser, assistant in dairying, is now in Europe studying the dairy interests of the more important dairy countries. G. P. Clinton, botanist of the station, has been granted leave of absence to spend the coming year in study at Harvard University. The station departments, with the exception of botany, will occupy quarters in the new agricultural building, the wings of which will be completed in September.

Purdue University.—W. E. Stone, Ph. D., professor of chemistry and vice-president of the university, has been elected president.

Kansas College and Station.—The agricultural department is now located in its new building, which is designed to accommodate that department in respect to class rooms and room for instruction in cheese making and butter making. The machinery for this work is not yet installed. The chemical laboratory was totally destroyed by fire originating in the dark room May 31, 1900. The records of the director's office of the station, the greater portion of the library and office furniture, and considerable apparatus were saved. Some of the samples for analysis in connection with digestion experiments were lost. Several hundred samples of corn which were in process of analysis in connection with work in seed breeding were saved. The fine collection of minerals and rocks, while largely removed from the building, was so badly damaged from the rough handling as to be of very slight value.

Maine Station.—At the June meeting of the board of trustees the following changes in the station staff were made: The resignation of A J Patten, assistant chemist, was accepted; C. D. Holley, B. S., University of Maine, 1900, was appointed assistant chemist; Perley Spaulding, B. S., University of Vermont, 1900, assistant in horticulture, beginning October 1, 1900; Gilman A. Drew, Ph. D., of Johns Hopkins University, entomologist, to date from September 1, 1900, *vice* F. L. Harvey, deceased. J. A. Roberts, of Norway, has been appointed a member of the board of control in place of Arthur L. Moore, whose term has expired.

Montana College and Station.—S. M. Emery, director and horticulturist, has resigned, and S. Fortier, irrigation engineer, has been elected director.

Oklahoma Station.—At a recent meeting of the board of regents E. E. Bogue, botanist and entomologist of the station, was granted a year's leave of absence for the purpose of studying certain plant diseases that have been engaging the attention of the station during the past year. E. M. Wilcox will be in charge of his department during the coming year.

Oregon Station.—B. G. Leedy, of Tigardville, has been elected master of the State grange, and thereby becomes *ex officio* member of the board of regents in place of W. M. Hilleary; and John T. Olwell, of Central Point, has been elected a member of the board in place of B. S. Pague.

South Carolina College and Station.—C. C. Newman has been elected horticulturist in the college and station.

Utah College and Station.—J. W. Kerr, for several years past president of Brigham Young College at Logan, has been elected president of the agricultural college, to succeed J. M. Tanner, resigned. The resignation of Luther Foster as director and agriculturist has also been accepted, and J. A. Widtsoe, formerly chemist, has been elected director.

Virginia College and Station.—John T. Brown, of Brierfield, has been elected rector of the board of visitors of the college and chairman of the board of control of the station in place of C. E. Vawter, resigned. W. A. Hill, of South Boston, has been appointed a member of the board of visitors. Contracts have been awarded for a large pig barn, designed for experimental work, and for a building for farm machinery, shops, etc.

Washington Station.—J. A. Balmer, horticulturist, has retired from the station to engage in commercial horticulture.

Wyoming Station.—B. C. Buffum, agriculturist, horticulturist, and vice-director, has resigned to accept the position of agriculturist in the Colorado college and station. Luther Foster has been elected to succeed him.

Appropriations for the U. S. Department of Agriculture.—The Congressional act making appropriations for the Department of Agriculture for the fiscal year ending June 30, 1901, shows an increase of nearly $300,000 over the appropriations for the preceding year. The total amount is $4,023,500, of which $720,000 is for the experiment stations in 48 States and Territories, and $10,000 for the purpose of commencing the necessary improvements for the establishment and maintenance of a general experimental farm and agricultural station on the Arlington estate, opposite Washington.

The largest increases in the appropriations are for the Bureau of Animal Industry, Weather Bureau, and the Divisions of Forestry and Seeds. The appropriation for the Bureau of Animal Industry is $1,078,830, an increase of $46,800. The appropriation for animal quarantine stations is increased from $12,000 to $50,000. The total appropriation for the Weather Bureau is $1,058,320, an increase of $35,838. The work of the Bureau is to be extended to the Hawaiian Islands. The Division of Forestry receives $80,000, an increase of $40,000, $5,000 of which may be used to investigate forest conditions in the Southern Appalachian Mountain regions of western North Carolina and adjacent States. The appropriation for the Division of Seeds is increased from $130,000 to $170,000. The increased appropriation for the purchase of seed is due in a large measure to a petition of some 225 Members of the House of Representatives.

The appropriation for the Office of Experiment Stations is $33,000, and the special investigations in charge of this Office are provided for as follows: Nutrition of man, $17,500, an increase of $2,500; irrigation investigation, $50,000, an increase of $15,000; $12,000 for the stations in Alaska; $10,000 for a new station in Hawaii; and $5,000 for investigating the agricultural resources and capabilities of Porto Rico, with reference to the establishment of stations there.

The scope of the work of the Division of Chemistry has been somewhat enlarged, and its appropriation increased by $1,000, being now $35,000.

The appropriation for the Division of Agrostology is increased $5,000, making a total of $25,100. The Division of Entomology receives $33,200, an increase of $2,500. Special investigations are ordered on "ravages of the codling moth, with a view to ascertaining the best methods for its extermination." The sum of $34,500 is appropriated for the Division of Vegetable Physiology and Pathology. The policy of Secretary Wilson in employing graduates of agricultural colleges as scientific aids has received the indorsement of Congress by an express provision for the employment in this Division of such aids. Of the $31,300 appropriated for the Division of Soils, $10,000 may be used "for the purpose of demonstrating the practical value of underdrainage and other methods of reclaiming alkali lands." The appropriation for this Division is $5,000 greater than last year.

The fund for investigations as to the adaptability of the South for profitable tea culture is increased from $1,000 to $5,000.

The fund provided for the Division of Publications is $130,020, an increase of $28,360. The amount set aside for the printing of Farmers' Bulletins is $22,500 greater than last year. Four-fifths of the Farmers' Bulletins are to be sent out by members of Congress instead of two-thirds as formerly.

Other items of the appropriation act are as follows: Biological Survey, $30,300, an increase of $2,740; Division of Botany, $43,080, an increase of $14,280; Division of Pomology, $18,400; Public Road Inquiry, $14,000, an increase of $6,000; Division of Statistics, $146,160; Library, $14,000; Museum, $2,260.

MEETING OF THE SOCIETY FOR THE PROMOTION OF AGRICULTURAL SCIENCE.—The twentieth annual meeting of the Society for the Promotion of Agricultural Science was held at Columbia University, New York, Friday and Saturday, June 22 and 23, 1900, in connection with the forty-ninth meeting of the American Association for the Advancement of Science. Dr. W. J. Beal, of Michigan, presided. A joint session with the Association of Economic Entomologists was held Saturday morning, June 23.

The papers presented included Presidential address (delivered in the joint session) and A syllabus for a course on grasses and other forage plants, W. J. Beal; The course of the hyphal filaments of Tilletia in the body of the wheat plant—a correction of an error, H. L. Bolley; Preliminary studies in soil bacteriology, F. D. Chester; Egyptian agricultural institutions, D. G. Fairchild; Development of forestry during the past twenty-five years, B. E. Fernow; Twenty years of progress in plant pathology, B. T. Galloway; Subarctic agriculture, C. C. Georgeson; Experiments in the apiary, C. P. Gillette; Seven years of field experiments with bush beans, B. D. Halsted; The progress in economic entomology during the nineteenth century, L. O. Howard; Some new facts regarding the destructive green-pea louse, with methods for its suppression and control, W. G. Johnson; Humus and soil fertility, E. F Ladd; The development of tomato hybrids, W. M. Munson; Syllabus of a course in the study of cryptograms and The weedy plants of Iowa, L. H. Pammel; Agricultural instruction by the University extension methods, I. P. Roberts; Experiments in liming, W. Frear; Influence of wheat farming upon the fertility of the soil, H. Snyder; The uses and abuses of fertilizer formulæ, S. M. Tracy; Plant breeding, W. W. Tracy; The botanic garden as an aid to agriculture, W. Trelease; How to teach agricultural chemistry to best combine the science of chemistry with the application of it to the affairs of farm life, E. B. Voorhees; Influence of meteorological conditions on the Hessian fly, F. M. Webster; A few points on how to make agricultural chemistry applicable to farm life, J. B. Weems; Formation of sodium carbonate or black alkali by saltbushes and Mutual solubilities of certain pairs of electrolytes in concentrated solutions, F. K. Cameron and F. D. Gardner; and Notes on the comparative hardiness and phenology of some southern and northern trees of the same kind, J. C. Whitten.

The officers elected for the ensuing year are W. J. Beal, Michigan, president; F. M. Webster, Ohio, secretary; and B. D. Halsted, New Jersey, additional member of executive committee.

MEETING OF THE ASSOCIATION OF ECONOMIC ENTOMOLOGISTS.—The twelfth annual meeting of the Association of Economic Entomologists was held at Columbia University, New York, Friday and Saturday, June 22 and 23, 1900, in connection with the forty-ninth annual meeting of the American Association for the Advancement of Science. In the absence of the president (L. Bruner) C. P. Gillette presided. The following papers were presented: Effects of spring application of insecticides, E. P. Felt; Notes on the Marguerite fly, H. T. Fernald; Notes from Colorado, C. P. Gillette; Present condition of the Blastophaga introduction experiment in California, on an introduced parasite of Ceroplastes, and on *Pentilia misella*, L. O. Howard; Notes on insects of economic importance for 1900, and The economic value of certain parasites, W. G. Johnson; The distribution of the brown-tail moth, A. H. Kirkland; Notes on *Diabrotica 12-punctata*, A. L. Quaintance; Hydrocyanic gas on low-growing plants, E. D. Sanderson; Meteorological influences on the development of the Hessian fly, and Insects of the year in Ohio, F. M. Webster; Notes on certain animal parasites, C. P. Lounsbury; Relations of *Pimpla conquisitor* to *Clisiocampa americana*, and an egg parasite of *Vanessa antiopa*, C. M. Weed; Notes from Canada, J. Fletcher; and Notes from California, C. W. Woodworth. For entomological papers presented in a joint session of this association and the Society for the Promotion of Agricultural Science see page 1099.

Officers for the ensuing year were elected as follows: President, C. P. Gillette, of Colorado; first vice-president, A. D. Hopkins, of West Virginia; second-vice president, E. P. Felt, of New York; secretary, A. L. Quaintance, of Georgia. The president, the first vice-president, and the secretary were constituted a committee to pass upon and record common names of insects to be hereafter proposed.

MEETING OF THE AMERICAN CHEMICAL SOCIETY.—The twenty-first general meeting of the American Chemical Society, in affiliation with the chemical section (C) of the American Association for the Advancement of Science, was held at Columbia University and the Chemists' Club, New York, June 25–30, 1900. Addresses were delivered by C. F. McKenna, chairman New York section American Chemical Society; W. McMurtrie, president of the society; and J L. Howe, vice-president Section C, American Association for the Advancement of Science, and some fifty papers were presented Those of especial interest from an agricultural standpoint were: The principal body to which the odor of jonquil is due, T. C. Stearns; The detection of coal-tar dyes in food products, A. L. Winton; Estimation of fat in sweetened condensed milk, J F. Geisler; Some analyses of milk and cream with reference to the condition of fat globules, H. C. Sherman; The action of various preservatives upon cider, E. H. S. Bailey; The toxic action of solutions of acid sodium salts on *Lupinus albus*, L. Kahlenberg and R. M. Austin; Investigations as to the nature of corn oils, H. T. Vulte and Harriet W. Gibson; Some results of experiments with the respiration calorimeter, W. O. Atwater; Notes on the determination of the spontaneous combustion of oils when mixed with wool waste, L. P. Kinnicut and H. W. Haynes; Application of chemical methods to the testing of wheat and flour, H. Snyder; Note on the determination of phosphorus as phospho-molybdic anhydrid, H. C. Sherman and H. S. J. Hyde; The adulteration and methods of analysis of the arsenical insecticides, J. K. Haywood, The composition and analysis of London purple, J. K. Haywood; New methods for the separation of some constituents of ossein, W. J. Gies; and Notes on the constituents of ligament and tendon, W. J. Gies.

MEETING OF THE AMERICAN FORESTRY ASSOCIATION.—The American Forestry Association, in affiliation with the American Association for the Advancement of Science, held meetings at Columbia University, New York, Monday and Tuesday, June 25 and 26, 1900. Addresses were delivered by the Hon. Warren Higley and by the Secretary of Agriculture, Hon. James Wilson, who presided, and a list of some 25 papers on various phases of forestry were presented.

EXPERIMENT STATION RECORD.

VOL. XI. No. 12.

The present number completes the eleventh volume of the Experiment Station Record, and is devoted as usual to the index of the volume. The labor incident to preparing an index of nearly 12,000 entries and putting it through the press is responsible for the delay in issuing it after the completion of the rest of the volume.

The present volume contains 868 pages of abstracts, representing 74,981 pages in the original publications. In addition to these abstracts the volume contains the titles of 2,247 articles, mostly foreign, which are briefly noted, but not abstracted. There are also 15 editorials, occupying 30 pages; 5 special articles, occupying 48 pages, and 129 station and miscellaneous notes, occupying 18 pages.

The review of literature relating to veterinary science has been made much more comprehensive than in previous volumes. The systematic abstracting of publications in the Dutch language has been added, and arrangement has been made for abstracting the agricultural literature in the Hungarian language, which contains much of interest and value.

With the pressure of matter it has been necessary to put more of the abstracts in brevier type than was formerly the case, in order to keep within bounds, and also to omit many of the details which were formerly included. This calls for closer discrimination on the part of the abstractors, and while it necessarily makes the Record more technical in its nature, it will make it more strictly a record of progress in agricultural science.

As the number of volumes of the Record increases the set becomes a more valuable compendium of recent literature on agricultural science and more useful as a means of getting together the literature on a given subject. To facilitate its use, the preparation of a combined index has been undertaken, to cover probably the first twelve volumes of the Record. Work on this combined index is well under way, but the labor involved is very large, and it can probably not be finished before the completion of Volume XII. Such an index will necessarily be less detailed than the index to the individual volumes, and will be made on a somewhat different plan in order to keep it within reasonable size. This can be done, however, without impairing its usefulness.

INDEX OF NAMES.

Aanestad, S., 734.
Abati, G., 772.
Abbe, C., 620.
Abbot, H. L., 480, 517, 620, 819.
Abbott, W. S., 937.
Abderhalden, E., 576.
Abegg, R., 129.
Abel, M. H., 278, 777.
Abel, R., 652, 693.
Abelous, E., 715.
Abraham, 133.
Achard, 193.
Ackermann, E., 87.
Ackroyd, W., 312.
Adamov, N., 623.
Adams, G. E., 262, 918.
Addams, J., 82.
Adil-Bey, 192, 289.
Adler, 515, 643
Agarev, A. I., 895
Ageenko, V., 561.
Ahlfvengren, F. E., 462.
Ahrens, C., 110.
Aikman, C. M., 489.
Aitken, A. P., 230, 319, 381.
Albaugh, N. H., 548.
Albertoni, P., 971.
Albuquerque, J. P. de, 840, 841.
Aldrich, J. M , 173.
Alén, J. E., 55, 354, 1055.
Alexander, A. S., 593.
Alexander, W. H., 430, 621.
Alford, A. H., 398.
Allen, E. W., 2, 209.
Allen, G., 870.
Allen, H. L., 430
Allen, R. G., 127
Allen, W. J., 272, 1048.
Almeida, V. de, 949.
Altum, 371.
Alvarez, T., 477.
Alvord, C. H., 298.
Alvord, H. E., 976, 988.
Alwood, W. B., 66, 128, 309, 455, 699, 851, 867, 931.
Amolin, V., 895.
Ames, O., 549.
Amiss, P. A., 199, 600.
Auchald, H. de, 897.
Anche, 394.
Anderson, A. P., 160, 403, 1000, 1061.
Anderson, L., 192, 384, 1081, 1097.
Anderson, W. B., 277, 335.
Anderson, W. C., 313.
Andieu, P., 50.
Andouard, A., 80.
André, E., 48, 454, 549.
André, G., 576, 1056.
Andreasch, F., 22.
Andreev, P. N., 893.
Andrews, C. C., 459.
Andrews, S. N., 1097.
Angell, J. B., 699.
Anglas, J., 765.
Angot, 1000.
Anstadt, A., 134.
Appel, O., 167, 562.
Appry, G., 1085.
Arcangeli, G., 121, 515.
Archbutt, L., 23.
Arenander, E. O., 184.
Arendrup, J., 643.
Arloing, S., 265, 695, 796.
Armijo, J., 298.
Armsby, H. P., 405, 407, 413, 483.
Arnao, E., 657.
Arndt, 894.
Arrow, G. J., 870.
Arthur, J. C., 356.
Aryazhev, 892.
Ascher, 887.
Aschman, C., 110, 507.
Aschman, F. T., 970.
Ashmead, W. H., 265, 271.
Aston, F. W., 313
Astruc, A., 813.
Athanasiu, J., 1076.
Atkinson, G. E., 425.
Atkinson, G. F., 322, 1014
Atkinson, J., 462.
Atterberg, A., 14, 1054.
Atwater, W. O., 372, 379, 576, 770, 835, 882, 971, 1075, 1100.
Atwell, W. P., 1092.
Atwood, H., 186, 774.
Aubry, L., 618.
Auchy, G., 906.
Aurivillius, C., 66, 1065.
Austin, M., 107, 419.
Austin, R. M., 1100.
Austin, W. H., 593.
Avery, S., 398.
Axe, W., 694.
Ayers, H., 425.
Aygalliers, P. de, 744.
Aylesworth, B. O., 199.
Ayers, H. B., 458.
Babb, J. G., 800.
Babcock, S. M., 579, 580.
Bachmann, H., 423.
Bachmetjew, P., 556.
Baessler, P., 55.
Bagge, F. 790.
Bail, O., 1091.
Bailey, E. H. S., 1100.
Bailey, F., 457, 941.
Bailey, F. M., 120 220, 454.
Bailey, G. H., 312.
Bailey, J. F., 220, 1057
Bailey, L. H., 49, 50, 52, 152, 999, 1022, 1045.
Bain, S. S., 351.
Baker, G. S., 996.
Baldassarre, S., 1077.
Baldensperger, P. J., 1064.
Baldoni, A., 495.
Balestrier, L. de, 1038.
Ball, C. R., 297, 651.
Ball, H. L., 129.
Balland, 482.
Ballard, J. D., 800.
Ballou, H., 852.
Balmer, J. A., 1045, 1098.
Balster, H., 331.
Baltet, C., 50.
Balthazard, 79.
Bang, B., 695, 795.
Baracchi, P., 222
Baranetzky, J , 319, 911.
Baranov, P., 98.
Barbacci, O., 591.
Barbagallo, P., 696.
Barber, V. C., 499.
Barbour, E. H., 896.
Barbut, G., 564.
Barker, F. C., 93.
Barkow, 193.
Barlow, E., 366, 1062.
Barlow, J., 994.
Barlow, W. H., 20.
Barnes, A., 483.
Barr, J. H., 799.
Barretto, L. P., 358.
Barron, L., 453.
Barth, M., 700.
Barth-Colmar, 45.
Barthel, C., 785.
Bartlet, M., 766.

Bartlett, J. M., 829, 964, 965, 974, 975.
Barton, J. M., 699.
Basch, K., 286, 387.
Bate, H. C., 126.
Bathie, P. de la, 853.
Battanchon, G., 44, 861.
Bauer, J. W., 127.
Baum, F., 214.
Baum, H., 195.
Bauman, K., 311.
Bauverd, 198.
Beach, C. L., 86.
Beach, S. A., 248, 253, 399, 453, 851, 1066.
Beal, W. H., 397.
Beal, W. J., 219, 260, 745, 747, 856, 1099.
Beals, E. A., 127.
Beam, 705.
Bean, W J., 353
Bear, W. E , 650.
Beardshear, W. M., 397
Beau, M., 489.
Beauverie, J., 860.
Beckmann, E., 313.
Beco, L., 287.
Bedford, S A., 831, 850, 852, 854, 855, 876, 881.
Behrens, H., 812
Behrens, J., 164, 927.
Behring, E., 288.
Beijerinck, M. W , 167, 359, 715.
Beinling, 462.
Beissner, L., 424
Beistle, C P , 625.
Belfanti, S., 495.
Bell, A. G., 609.
Bell, E. W , 109.
Bellair, G., 451.
Bellier, M J., 510
Bénard, H., 311
Benedict, F. G., 213, 770, 882
Bennett, C W., 1048.
Bennett, R. L., 921, 923, 926, 927, 965.
Benson, A. H., 174, 372, 744, 959.
Benson, A. S., 199.
Benson, C., 759, 842.
Benton, H., 240, 241, 251.
Bérard, de, 497.
Berezov, F , 895
Berg, C., 1066
Berg, O., 133.
Bergey, D. H., 1007.
Bergholz, P., 620.
Bergman, A., 564, 1063, 1090.
Bergstrand, A., 393
Berlese, A., 274, 656.
Berlese, A. N , 261, 700.
Bernard, A., 618.
Bernard, E., 380.
Bernard, M., 355.
Bernátsky, J., 910.
Bernays, L A., 549.
Bernier, D., 91.
Bernier, G. J., 194.
Berry, J., 430.
Bersch, W., 418.
Bertarelli, E., 375.
Bertenson, V., 745.
Berthault, F., 497.
Berthelot, D., 511.
Berthelot, M., 420, 482, 576, 617, 905.
Berthonneau, J., 1038.
Berthoud, E. L., 458.
Bertoni, M. S., 240, 241, 242, 261.
Bertrand, G., 124, 125.
Beseler, W., 442.
Besnoit, C., 93.
Besredka, 91.
Bessey, C. E., 314, 468, 858.
Betts, A., 620.
Bevier, I., 961.
Beythien, A., 618.
Bichev, P., 1091.
Bickel, A., 22.
Bieler, S., 592.
Biffin, R. H., 28.
Bigelow, F. H., 430, 432, 620, 621.
Bigelow, S. L., 313.
Biggs, E. D., 99.
Billitz, G., 191, 696.
Binot, J , 192.
Bioletti, F. T., 46.
Birchmore, W. H., 1025.
Birdsong, M. S., 200.
Birk, C. V., 294.
Bishop, J. S., 957.
Bishop, W. H., 430.
Bitting, A. W., 290, 998.
Bittinger, J. L , 490.
Bizzell, J. A., 278, 298, 600.
Bjerknes, 716.
Bjerre, P., 971.
Blackwood, W. J., 984.
Blair, A. W , 200, 229, 328.
Blair, J. C., 258.
Blair, W. S., 850.
Blank, O., 419.
Blasdale, W. C., 777.
Blasig, F., 1018.
Blaustein, Z., 795.
Bliss, C. L., 125, 511, 715.
Blouin, R. E., 208
Blumenthal, F., 23.
Blunno, M., 272, 477, 563.
Blyth, A W., 21.
Boas, J. E V., 657.
Böder, 696.
Bodmer, R., 705.
Boeken, H J., 733.
Boekhout, F. W. J., 488.
Bogdanov, S., 130, 723, 724.
Boggild, B., 87, 188, 789.
Bogue, E. E., 354, 1067, 1098.
Bogue, J. T., 252.
Bohlig, E., 813.
Böhm, J., 797.
Bokorny, T., 168, 555.
Bolley, H. L., 361, 786, 817, 1099.
Bolling, R., 510
Bolton, W. E., 800.
Boltshauser, H., 876.
Bomberger, H., 212.
Bömer, A., 312.
Bommer, C., 759.
Bonâme, 858.
Bone, J. H., 99, 433, 1015, 1036, 1069.
Bonjean, E., 417.
Bonnema, A. A., 419.
Bonnesen, E. P., 97.
Bonnet, A., 52, 122, 167.
Bonnier, G., 421, 1015.
Booth, N. O., 152.
Bord, J., 451.
Börnstein, R., 1018.
Bornträger, A., 882.
Borthwick, A. W., 469.
Bosredon, A. de, 252.
Boss, A., 638.
Bostrom, A., 592.
Botazzi, F., 79
Bouchar, 184.
Bouffard, A., 294, 652.
Bougueret, M., 489.
Bouilhac, R., 1016.
Boulon, F., 251.
Boultbee, J W., 895.
Bourquelot, E., 214, 511, 906, 1056.
Boutilly, V., 453, 1048.
Bovell, J. R., 840, 841.
Bowman, H. D., 298.
Boyce, R., 426.
Boyce, S., 442.
Boyd, A. J., 240, 442.
Boyer, G., 159.
Boyer, L , 135.
Boynton, H. R., 620.
Bra, 950.
Brackett, G. B., 399, 452.
Bradford, J. R., 592.
Bradley, W. P., 214.
Brandenburg, F. H., 126.
Brandin, A., 750.
Brandis, D., 941.
Brandt, L , 311.
Brante, L. B., 796.
Braucher, R. W., 274.
Brault, J , 1088.
Braungart, R., 43, 483.
Braunmuller, E., 710.
Bray, W. H., 999.
Bréal, E., 815.
Brearley, H , 813
Breckons, J. A., 798.
Breden, A., 251.
Bredig, G., 706.
Breme, H., 134.
Bremer, H., 672, 814.
Brendle, A. S., 127.
Bresadola, G., 424.
Breteau, B., 214.
Bretigniere, L., 576.
Breustedt, G., 419.
Breymann, L., 1094.
Brick, C., 655.
Briggs, L. J., 325, 434.
Brigham, A. A., 972.

Briosi, G., 256, 259.
Brittlebank, J. W., 92.
Britton, W. E., 270, 722, 742, 745, 762.
Brizi, U., 220, 554.
Brockenbrough, B. B., 699.
Broden, A., 92.
Brodie, F. J., 1051.
Broilliard, 941.
Bronson, B. H., 127.
Brooks, W. P., 137, 516, 529, 538, 542, 572.
Brotherston, R. P., 154, 352, 454.
Brouillard, 718.
Brown, E., 673.
Brown, H. T., 54, 1015.
Brown, J. T., 299, 1098.
Brown, T., 452.
Browne, C. A., jr., 307, 308, 615, 616.
Brucker, 767.
Bruhns, G., 213, 214, 306.
Bruijning, F. F., 56, 748.
Brüller, 288.
Bruncken, E., 941.
Bruner, L., 370, 563, 565.
Bruns, H., 393.
Brusasco, L., 291.
Brutskus, B. K., 275.
Bryan, A. H., 236.
Bryant, A. P., 375, 379, 482, 770
Bryant, A. W., 371.
Buard, 394.
Bubak, F., 59.
Buchner, E., 713.
Buckham, M. H., 407.
Buckton, G. B., 957.
Budd, J. L., 647.
Budde, C. C. L. G., 306.
Buffum, B. C., 411, 1026, 1052, 1098.
Buhler, 718.
Buisson, J. M., 153
Bunge, 279.
Bunge, G. von, 212.
Bunting, M., 818.
Burbridge, F. W., 453, 1049.
Burchard, O., 1054.
Burgerstein, A, 355.
Burgess, A. F., 560, 954.
Burguy, G. F., 434.
Büring, L., 52.
Burkett, C. W., 136, 188, 967.
Burlakow, G., 29.
Burnett, E. A., 297, 878.
Burrell, M., 563.
Burrill, T. J., 250.
Burtis, F. C., 200, 487.
Bussard, L., 259, 468.
Buttenberg, P., 652.
Butterwick, O. C., 153.
Butz, G C., 452.
Byers, M. V., 192.
Cadéac, 191, 289, 697.
Cadiot, P. J., 793, 1092.
Cady, W. B., 1078.
Cagny, P., 577.
Caldwell, G. C., 547.
Caldwell, J. R., 399, 351.
Callari, I., 1067.
Calloway, J. D., 99.
Caluwe, P. de, 239.
Calvert, E. B., 126, 127, 222.
Camerer, W., 313.
Cameron, C. A., 577.
Cameron, F. K., 1099.
Cameron, J., 1060.
Cameron, S. S., 695.
Campagne, A., 60.
Campagne, M., 60.
Campbell, A. W., 294.
Campbell, D. H., 318.
Campbell, E. D., 613.
Campbell, J. R., 87, 283, 332.
Campbell, W. S., 457.
Campos da Paz, 154.
Campos Novaes, J. de, 260.
Camus, E. G., 120.
Cantacuzène, J., 589.
Capus, J., 469, 758.
Capus, M., 548.
Card, F. W., 645, 928.
Carl, 896.
Carles, P., 1025.
Carleton, M. A., 942.
Carlisle, W. W., 127.
Carlyle, W. L., 567, 570, 595.
Carmody, P., 184, 718, 843.
Carnot, P., 796.
Carpenter, F. A., 430.
Carpenter, G. H., 272, 657.
Carpenter, L. G., 199, 323, 394, 412.
Carpenter, V. H., 562.
Carré, A., 44, 937.
Carriere, G., 194.
Carson, C. A., 99.
Carter, J. M., 996.
Carver, G. W., 146.
Cary, A., 747.
Casagrandi, O., 557, 995
Cesaris-Demel, A., 794.
Casey, J. R., 371.
Caspari, W., 658, 973.
Casper, M., 895.
Cassez, M. E., 1036.
Castel, E., 490.
Castex, 59.
Castle, R. L., 946.
Castro, L. de, 341.
Cathcart, A. H., 78.
Causse, X., 619.
Cavara, F., 167, 469.
Cave, T. W., 88.
Cazeaux-Cazalet, G., 469.
Cazeneuve, P., 214.
Cecconi, G., 564.
Celli, A., 557.
Céris, A. de, 937.
Chaffee, F. P., 126.
Chalmot, G. de, 300.
Chalon, J., 516.
Chamberlain, A., 459.
Chamberlain, C. J., 28, 29.
Chamberlain, J., 871.
Chambliss, C. E., 298.
Chambrelent, 394.
Chapelle, P., 419.
Chappel, G. M., 126.
Charguerand, 50.
Chatanay, G., 619.
Chatelain, E. U., 214.
Chatfield, J. L., 199, 600.
Chatin, A., 851.
Chaussée, P., 892.
Chauveau, 184.
Chauveau, A. B., 432.
Chenier, G., 91.
Chercheffsky, N., 419.
Chesnut, V. K., 413, 909.
Chester, E. G., 457.
Chester, F. D., 424, 434, 435, 468, 490, 493, 1099.
Chevalier, C., 51.
Chibret, P., 23.
Chifflot, G., 469.
Chilcott, E. C., 43, 44, 51, 97.
Chistovich, F. Y., 892.
Chittenden, F. H., 362, 470, 746.
Cimmino, R., 811.
Choate, A. B., 396.
Chodounsky, F, 1048.
Cholodkovsky, N., 657.
Chrétien, P., 1065.
Christy, W. A., 1016.
Chrysostom, B. J., 172.
Chuard, E., 138, 371, 1026.
Church, A. H., 575.
Cieslar, 1061.
Clark, H. A., 297.
Clark, J., 226.
Clark, J. F., 710, 910.
Clark, R. W., 499.
Clark, W. B., 799.
Clarke, W. H., 45.
Claudius M., 1016.
Clausen, 910.
Clautriau, G., 999.
Clayton, E. G., 212.
Clayton, H. H., 516.
Clayton J., 31.
Clemons, L. E., 199.
Cline, I. M., 128, 620.
Clinton, G. P., 1097.
Clinton, L. A., 294, 331.
Close, C. P., 299, 945, 949.
Clothier, G. L., 333, 420
Clothier, R. W., 200, 236, 432.
Clowes, G. H. A., 705.
Cloyd, D. M., 200, 229.
Coates, C. E., 408.
Cobb, N. A., 415.
Cobbett, L., 794.
Cobleigh, W. M., 305, 823.
Cochran, C. B., 82, 970.
Cockerell, T. D. A., 421, 499, 956.
Cohn, A. I., 619.
Cohn, R., 576.
Coker, D. R, 439.
Colby, G. E., 46.
Collin, E., 482.
Collins, B. W., 890.
Collins, J. B., 458.

Colucci, V., 696.
Comstock, J. H., 562.
Conger, N. B., 126, 620, 912.
Conn, H. W., 189, 285, 390, 886, 889, 890, 911.
Connaway, J. W., 796, 988.
Connell, J. H., 233.
Conner, C. M., 233.
Connor, P., 126, 127.
Connstein, W., 883.
Conradi, H., 795.
Consiglio, M., 122.
Constant, L., 288.
Cook, A. J., 271.
Cook, O. F., 319, 1015.
Cooke, W. W., 337, 339, 378, 379, 412, 428.
Cooley, G. W., 221, 223.
Cooley, R. A., 563.
Coote, A. H., 214.
Coote, G., 450.
Coquillett, D. W., 563, 958.
Corbett, L. C., 251.
Cordley, A. B., 371, 466.
Cornevin, C., 287.
Cornwall, F. E., 398.
Correns, C., 700, 1016.
Correvon, H., 52.
Cory, C. L., 415.
Coste-Floret, P., 60.
Costerus, J. C., 355.
Cottrell, H. M., 199, 377, 487, 926, 1037.
Couanon, G., 658.
Coulter, J. M., 709, 909.
Coupin, H., 24, 119, 715, 1056.
Courtois, E., 242.
Cousins, H. H., 340, 733.
Couteaux, 1075.
Coventry, B. O., 1066
Covert, J. C., 380, 1038.
Coville, F. V., 429.
Cowles, H. C., 321.
Cox, H. J., 126, 127.
Crafts, H. A., 912.
Crahay, N. I., 747.
Craig, J., 152, 252, 399, 549, 851, 929.
Craig, M., 499.
Craig, W., 598.
Craig, W. N., 428.
Craigie, P. G., 296.
Crampton, C. A., 312.
Crandall, C. S., 53, 245, 314.
Crane, A. B., 127.
Cranefield, F., 540, 547, 1048.
Craw, A., 414, 558.
Crawford, W. T., 172.
Cremer, M., 483.
Crescimanno, S., 996.
Crispo, M. D., 417.
Critzman, 91.
Croesen, V. R. I., 193.
Cronk, C. P., 127.
Crooks, W., 444.
Crouzet, E., 470.
Crowe, R., 888.
Cruderic, G., 469.
Cruz, G., 91.
Csercháti, A., 232.
Cuboni, G., 362, 477.
Cuniasse, L., 618.
Cunningham, C. A., 756, 859.
Curtice, C., 200, 593, 997.
Curtis, C. E., 1050.
Curtis, H. E., 627.
Curtiss, C. F., 86, 229, 284, 381, 688.
Cushman, S., 972.
Cuthbertson, D., 127.
Czapek, F., 322, 516.
Dabney, C. W., 98.
Dadant, C., 271.
Dafert, F. W., 34, 352, 1026.
Dahl, C., 643.
Dal Paiz, 253.
Dalziel, H., 93.
Dammer, U., 64, 247.
Damseaux, A., 230.
Daniel, L., 343, 351, 910.
Daniels, F. P., 1015.
Dannfelt, H. J., 97.
Danysz, J., 390, 892.
Darton, N. H., 31.
Darwin, F., 114.
Dauthenay, H., 44, 154, 155, 168, 352, 469, 744.
Davids, 288.
Davidson, R. J., 838.
Davies, C. B., 587.
Davin, V., 51.
Davis, A. P., 31, 430.
Davis, K. C., 650, 709, 852.
Davis, M. T., 1000.
Davison, A. G., 191, 997.
Davison, G. M., 429.
Davy, J. B., 415, 543.
Dawson, C., 557.
Dawson, C. F., 979, 984, 994.
Dawson, M., 25, 711.
Day, C. M., 390.
Day, G. E., 664, 666, 668, 688, 997.
Deacon, W., 1061.
Deadwyler, A. V., 899.
Dean, H. H., 666, 674, 681, 683, 688, 689.
Dean, R., 154, 650.
Debray, F., 59.
De Campine, 540.
Decaux, F., 175.
Dechambre, P., 1085.
Decker, J. W., 284, 299, 490, 580, 581, 584, 587, 885, 984.
Dedyulin, A., 1089.
Degrully, L., 60, 262, 452, 549, 650, 745
Dehérain, P. P., 42, 218, 227, 319, 337, 538, 828, 829.
Dehlholm V., 812.
De Jong, D. A., 894.
Delacroix, 469, 871, 948.
Delépine, S., 394.
Del Rio, L., 288.
Dembinski, 193.
De Meijere, J. C. H., 870, 871.
De Montaignac, 970.
Demoussy, E., 212, 216, 1009.
Denman, E., 296.
Dennig, A., 184.
Denton, A. A., 293.
De Riemer, W. E., 599.
Derrough, G., 52.
Des Bois, F., 454.
De Scabra, A., 370.
Desgrez, 79.
Desmaroux, 826.
Desmoulins, 128.
Desprez, F., 341, 643.
Dessy, S., 997.
De Stefani, 262.
Destree, 79.
De Toni, J. B., 700.
Deutsch, L., 689.
Devauchelle, 561.
Devaux, V., 1025.
Devel, D. V., 594, 896.
Dewey, L. H., 462.
Dexter, E. G., 620.
Dick, S. B., 153.
Dickens, A., 200.
Diederich, H. W., 443.
Dieterich, K., 1008.
Dikovski, N., 893.
Dinwiddie, R. R., 689.
Dinwiddie, W., 497.
Di Vestea, 592.
Dixon, E., 240.
Dixon, H., 174.
Dixon, H. H., 221.
Dixon, R. W., 593, 993.
Doane, C. F., 297.
Doane, R. W., 1064.
Dobeneck, 1057.
Dod, C. W., 249.
Dodge, M., 498.
Dodson, W. R., 28, 397.
Dolby-Tyler, C. H., 563.
Dollar, J. A. W., 291, 495.
Dönits, W., 92.
Dorner, O., 395.
Dorry, 452.
Dorset, M., 996.
Dorsett, P. H., 454, 947.
Dorsey, N. E., 222.
Dosch, H. E., 851.
Douglas, 889
Dowzard, E., 311, 312.
Drenenstedt, J. H., 80.
Drew, G. A., 1097.
Dreymann, 191.
Drouineau, A., 1075
Dryden, J., 432, 480.
Dshunkovsky, E. T., 290.
Du Bois, J. E., 199.
Dubois, U., 380.
Duclaux, 977, 1085.
Duclert, L., 88.
Ducomet, V., 362, 759, 1061.
Duff, A. H., 266.
Duffourc-Bazin, G., 758.
Dufour, J., 362, 821.
Dugdale, J. M., 490.

Duggar, B. M., 57, 162, 164, 422, 757.
Duggar, J. F., 139, 232, 921.
Dumont, R., 381.
Dunbar, J., 550.
Dunham, J. W., 600.
Dunlap, H. M., 258.
Dunlop, J. C., 575.
Dunstan, N. J. R., 71.
Dupont, 576, 828.
Du Pre, J. F. C., 153, 298, 1047.
Duprez, 796.
Durand, M. E., 936
Durfee, B., 424.
Duryee, A. W., 297.
Dusserre, C., 355, 932, 1026.
D'Utra, G., 643, 644, 842, 916, 1038, 1048, 1049.
Duvel, J. W. T., 398.
Duyk, M., 814.
Dwyer, J., 253.
Dwyer, T. J., 1048, 1049.
Dyar, H. G., 265.
Dybowski, M., 576, 1049.
Dymond, T. S., 326, 328.
Eagan, P. R., 882.
Eardley-Wilmot, S., 1052.
Earle, F. S., 399, 1041.
Eastes, G. L., 677.
Eber, A., 194, 289.
Eber, W., 707, 1092.
Ebermayer, 718
Eckenbrecher, 255.
Eckles, C. H., 388.
Edington, A., 796.
Eddy, W., 1091.
Eddy, W. A., 222.
Edgar, P. M., 695.
Edge, T. J., 917.
Edington, A., 192.
Effront, J., 311, 813, 971.
Eggers, H., 564.
Egorov, J., 508.
Ekkert, N. I., 895.
Elbs, K., 619.
Eldridge, M. O., 395, 498.
Ellenberger, 195, 973.
Elliott, E. E., 200.
Ellis, S. H., 200, 820.
Ellms, J. W., 311, 312.
Elmendorf, C. H., 966.
Eloire, 789.
Emerson, J. B., 549.
Emery, C., 870.
Emery, F. E., 200, 276, 483, 1032, 1073, 1078.
Emery, S. M., 246, 251, 399, 1037, 1046, 1048, 1051, 1097.
Emery, S. S., 22.
Emmerich, R., 194.
Emmerling, O., 505, 506.
English, L. W., 348.
Engström, N., 680, 681.
Enoch, C., 767.
Epstein, S., 420, 715.
Ericksson, J., 59, 554, 556, 948.
Escombe, F., 54, 55.
Eskridge, A. T., 209, 299.
Espin, J. C., 644.
Estaunié, E., 715.
Estor, 289.
Euler, H., 1016.
Evans, E. A., 430.
Evans, H. B., 1061.
Evans, W. H., 28.
Everett, W. W., 941.
Evermann, B. W., 899.
Evsyeenko, S. S., 893.
Ewart, J. C., 1077.
Ewert, 1066.
Faber, H., 110.
Fabretti, C., 696, 797.
Faig, J. T., 415.
Fain, J. R., 298.
Fairchild, D. G., 725, 1047, 1099.
Fairchild, E. T., 199.
Fairfield, W. H., 1026.
Falcone, G., 393.
Faliès, G., 627.
Falk, O., 483.
Falke, F., 587.
Falkenberg, H., 240.
Fall, H. C., 871.
Farcy, J., 150.
Farmer, J. B., 118.
Farmer, L. J., 650.
Farnham, P. W., 200.
Farquhar, J. K. L. M., 938.
Farrer, W., 217.
Farrington, E. H., 188, 673, 1085.
Fascetti, G., 79, 134.
Fatzer, 469.
Faust, J. K., 313.
Favard, J. F., 168, 1062.
Faville, E. E., 171, 349, 371.
Fawcett, J. W., 458, 747, 1052.
Faxon, F. R., 970.
Fayet, G., 128.
Feilitzen, C. von, 435.
Felt, E. P., 272, 273, 564, 656, 951, 952, 1100.
Féré, C., 1093.
Ferguson, A. M., 499.
Ferguson, R. C. M., 457, 941.
Fernald, C. H., 559, 561.
Fernald, H. T., 398, 955, 956, 957, 958, 959, 1100.
Fernow, B. E., 746, 1050, 1099.
Ferris, E. B., 1022, 1068.
Ferrouillat, P., 263.
Ficalbi, E., 957.
Field, G. W., 29, 80.
Field, J. E., 95.
Field, M., 200, 786.
Fields, J., 100, 223, 277, 1017, 1022, 1036, 1051, 1057, 1061, 1066, 1076, 1084.
Fifield, O. E., 275.
Figdor, W., 118.
Fink, B., 28.
Finkenbeiner, H., 419.
Fischer, H., 217.
Fischer, M., 540, 673.
Fischer, P., 199.
Fixter, J., 863.
Flack, W., 393.
Flaminio, B., 647.
Flammarion, C., 819, 821, 907.
Flatten, W., 192.
Fleet, W. J., 172.
Fletcher, J., 558, 565, 862, 957, 1100.
Fletcher, S. W., 851, 1052.
Fleurent, M., 1075.
Flexor, D., 294.
Flickinger, G. A., 298.
Flocard, 86.
Florén, A. G., 695.
Floyd, M. L., 726.
Flügge, 694.
Foaden, G. P., 120, 437, 563, 725.
Foerster, O., 212, 311.
Followell, O., 970.
Folwell, A. P., 798.
Fonseca, A., 496.
For, P., 745.
Forbes, A. C., 221, 458, 477, 940, 1052.
Forbes, R. H., 213, 236, 240, 812.
Forbes, S. A., 274, 654, 958.
Forbush, E. H., 559, 712, 953, 954.
Forestier, L., 172.
Formánek, J., 672, 1007.
Forristall, E. H., 297.
Förster, K., 672.
Fortier, S., 798, 1097.
Foster, A. W., 1097.
Foster, E. A., 99.
Foster, L., 441, 663, 1075, 1098.
Foth, 594.
Foulerton, A. G. R., 582.
Foussat, J., 450
Fowler, C., 1097.
Fox, C. P., 872
Fox, W. J., 66.
Francé, R., 362.
Francis, M., 988.
Francke, 291.
Frank, 64, 166, 372, 424, 465, 468, 861, 1061.
Frank B., 468.
Franke, E., 134.
Fränkel, C., 694.
Frankenfield, H. C., 223, 620, 621.
Frankforter, C. B., 618.
Frankland, E., 300.
Franklin, G. E., 127.
Fraps, G. S., 278.
Fraser, W. J., 1097.
Frazer, W. B., 297.
Frear, W., 207, 625, 917, 924, 1099.
Freda, P., 300.
Freire, D., 713.
French, E., 650.
French, H. T., 413.
Frentzel, J., 778.
Freudenreich, E. von, 787, 980.
Frichot, E., 843.
Frick, 291.
Friedenthal, H., 778, 892.
Friedrich, P. L., 694.

Friend, H., 564.
Friis, F., 68, 85, 890, 780, 782.
Friis, L., 296.
Frissell, H. B., 961.
Froggatt, W. W., 178, 272, 273, 561, 563, 564, 658, 766.
Fron, G., 1049.
Fruwirth, C., 843.
Fuchs, G., 998.
Full, G., 1085.
Fuller, C., 477, 871.
Fuller, V. E., 983.
Fulton, M. W., 40, 96.
Fulton, W. M., 127, 499.
Gabain Bros., 482.
Gabbrielli, F., 381.
Gadd, W. L., 311.
Gadola, A., 618.
Gaillot, L., 128, 138.
Gain, E., 254.
Galbraith, S. J., 51.
Gale, A., 172, 271, 657.
Gale, A. H., 620.
Gallier, A., 770.
Gallo, G., 299.
Galloway, B. T., 259, 260, 852, 1099.
Galloway, R., 457.
Galtier, V., 697, 893.
Gambarotta, G., 796.
Gamble, J. S., 950.
Ganglbauer, L., 562.
Gannett, H., 456.
Ganong, W. F., 28.
Garcia, F., 1044.
Gardner, F. D., 912, 1099.
Garfield, C. W., 400.
Garman, H., 169, 260, 261.
Garola, C. V., 32.
Garriott, E. B., 126, 517.
Garten, T. R., 1039.
Gatta, R., 390.
Gauchery, P., 910.
Gauckler, H., 767.
Gaudelette, 599.
Gautier, A., 133.
Gautier, D., 796.
Gavillet, 198.
Gawalowsky, A., 313.
Gaylord, A. S., 154.
Gayon, U., 126.
Gazeau, C., 448.
Geisler, J. F., 380, 1100.
Gelm, G., 469.
Gengou, O., 494.
Genman, G. S., 352.
George, H., 92.
Georgeson, C. C., 42, 497, 499, 1099.
Gérard, E., 715.
Geret, L., 672, 715.
Gerland, B. W., 312.
Gerosa, G., 191, 696.
Geschwind, L., 643.
Getaz, A., 271.
Ghigi, F., 134.
Giard, A., 861.
Gibson, H. W., 1100.
Gibson, J. I., 288.
Gies, W. J., 1100.
Giesecke, H., 490.
Gifford, J., 485, 1052.
Gigl, E., 482.
Gilbert, A. G., 880.
Gilbert, F. N., 398.
Gilbert, J. H., 444, 842.
Gilchrist, D. A., 239, 327.
Gilkison, W. F., 415.
Gillanders, F., 842, 894, 1076.
Gillette, C. P., 370, 476, 1099, 1100.
Gilliéron-Duboux, 198.
Gillot, H., 20, 715.
Gilruth, J. A., 978, 995, 997
Gintl, W., jr., 311.
Girard, A., 759, 1075.
Girard, A. C., 576.
Girard, C., 618.
Girschner, E., 272.
Given, A., 297.
Gladden, H. P., 931.
Glaser F., 310.
Glass, E. J., 126.
Glazier, H. E., 99.
Glenn, S. W., 126.
Glover, G., 600.
Gmelin, 289.
Gobnet, J., 598.
Goblet, L., 419.
Goessmann, C. A., 137, 508, 509, 525, 526, 527, 528, 1026.
Goessmann, C. I., 508
Goethe, R., 870.
Goff, E. S., 150, 244, 399, 415, 511, 514, 560, 749, 930.
Goldberg, S. J., 995.
Golding, J., 516.
Goldschmidt, H., 880.
Gomez, A., 31.
Gonnerman, M., 321.
Gooch, F. A., 107, 419.
Goode, J. B., 398.
Goodell, H. H., 397, 406.
Gordon, J. S., 540.
Gordzyalkovski, I., 893, 895
Görig, 494.
Gorini, C., 388.
Gos, F., 469.
Gosney, E. S., 748.
Goss, A., 207, 411, 1035.
Gostling, F., 695.
Götze, A., 814.
Gouin, A., 80.
Gouin, R., 285.
Gouirand, G., 168, 469.
Gould, H. P., 297.
Gowell, G. M., 284, 800, 969, 983.
Graewitz, F., 321.
Graf. 394.
Graftiau, J., 529, 619, 1057.
Graham, R. D., 275.
Grahm, N., 733.
Grandeau, L., 44, 79, 335, 1075.
Grange, E. A. A., 998.
Gras, Q., 811.
Grashoff, W., 141.
Grassberger, R., 698.
Graves, H. S., 456, 900, 938.
Graves, S. H., 200, 699.
Greathouse, C. H., 250.
Greaves, R. M., 490.
Green, E. E., 476, 477, 563, 564, 967.
Green, J. R., 123, 714, 715.
Green, S. B., 399.
Green, W. J., 50, 150, 274, 451, 851.
Greenman, J. M., 121.
Greg, P. H., 443.
Greiner, 151.
Greiner, F., 870.
Griacosa, P., 481.
Griffin, H. H., 339.
Griffith, E. M., 458.
Griffon, E., 119, 513, 1010, 1011.
Grigorev, V., 895.
Grill, C., 66.
Grimm, 788.
Grindley, H. S., 82.
Gripenberg, N., 790.
Gripenberg, R., 682.
Grisdale, J. H., 968.
Groat, B. F., 620.
Grosdemange, C., 154.
Gross, E., 228, 476, 539.
Grotenfelt, G., 59, 98.
Grout, A. J., 260.
Grude, J., 779.
Grueber, von, 831.
Gruner, H., 435.
Grunsky, C. E., 196.
Gruss, J., 710.
Gryner, S. A., 896.
Gueguen, F., 949.
Guenther, A., 91.
Guercio, G. del, 367, 474, 564.
Guérin, P., 220, 700, 906.
Guffroy, C., 121.
Guichard, P., 618.
Guillon, J. M., 168, 450, 469.
Guion, A., 155.
Guiseppe, R., 796.
Gun, J., 429.
Gundy, J A., 941.
Günther, H. K., 45, 144.
Günther, R. T., 434.
Guozdenović, F., 198.
Gurgi, V., 125.
Gurler, G. H., 688.
Gustiniani, E., 330.
Guthrie, F. B., 229, 242, 272, 831
Guttmann, A., 44.
Gwinner, G., 415.
Haar, D. T., 1065.
Habernel, P., 926.
Hackett, A. E., 127
Hadi, S. M., 144.
Hadwin, O. B., 745.
Haecker, A. L., 279.
Haecker, T. L., 390, 397, 490.
Haffkine, W. M., 291, 393.
Hagemann, O., 72, 381, 483, 484, 772, 778.

Hahn, M., 715.
Halley, L. O., 1000.
Haines, A. L., 489.
Hale, J. H., 351, 399.
Hall, F. H., 52, 66, 80, 178, 241, 258, 262, 278, 871, 949, 1061.
Hall, S. M , 1049
Hall, W. E , 145.
Hall, W. L., 349, 535.
Hallidie, A. S., 1097.
Halphen, C., 510.
Halsted, B. D., 25, 112, 121, 469, 739, 743, 749, 750, 758, 946, 949, 1036, 1099.
Hammar, S., 56.
Hammerl, H., 697.
Hammon, W. H., 126, 129.
Hammond, H., 439.
Hamoir, 193.
Hanausek, T. F., 79, 510.
Haney, J. G., 200, 1037.
Hannamann, S., 145.
Hansard, A. C., 144.
Hansen, 894.
Hansen, C., 674.
Hansen, E C., 125.
Hansen, N. E , 400, 451, 848, 1037.
Hansteen, B., 1015.
Hanuš, J., 584, 619.
Harcourt, R., 617, 662.
Hardin, M. B., 438, 1024.
Hardin, W. L., 619.
Harding, E. P , 618
Hardy, J C., 899.
Hardy, T., 650.
Harkness, W., 221.
Harlay, V., 576.
Harley, V., 276.
Harnack, E., 483.
Harrington, H. H., 438
Harrington, M. W , 621.
Harris, 549.
Harris, C. D., 200
Harris, C. E., ..98.
Harris, F. E , 99.
Harris, J., 199, 600.
Harris, W T , 621.
Harrison, F. C , 649.
Harrison, J. B , 249, 352, 1038
Harrison, L , 99
Harshberger, J W., 818
Hart, J. H., 166, 500
Hartig, R., 556, 1052, 1061.
Hartleb, R., 110, 715, 1016.
Hartshorne, J., 937.
Hartwell, B. L., 206, 311, 438, 627, 834, 905, 1003, 1026
Harvey, F. L., 909 956, 958, 959, 1097.
Haselhoff, E., 331, 644, 812
Haselhoff, G., 134.
Haskins, H. D., 508, 525.
Hasterlik, A., 312
Hatfield, G., 351.
Hausner, A., 278.
Hawgood, H.. 940.
Hawkins, B. C , 221.
Hawks, A. McL., 222.
Hawley, A. M., 199.
Hayne, A. P., 1097.
Haynes, H. W., 1100.
Hays, W. M., 638.
Hayward, H., 83, 84.
Haywood, J. K., 213, 619, 1100.
Haywood, W. G., 200.
Hazen, H. A., 30, 126, 127, 430, 821.
Hazen, J. S., 620.
Heape, W., 791.
Heaton, H. H., 428.
Hobebrand, A , 313.
Hébert, A., 320.
Hebrant, 191.
Hecke, L., 255, 468.
Heckel, E., 467, 1012.
Hecker, 92, 495.
Hedges, C., 1092.
Hedrick, U. P., 275, 299.
Hefelmann, R., 22
Hegyi, D., 861.
Hehner, O., 213, 583.
Heine, H., 442.
Heineman, H. N., 1067.
Heinrich, 917.
Held, P , 469, 556.
Hellmann, G., 223.
Hollström, P., 185, 627.
Helme, N., 911.
Hempel, A., 476.
Hempel, H , 618.
Hemsley, A., 453, 550.
Henderson, L. F., 1059
Henderson, R., 285, 205
Henning, E , 259.
Hennings, P , 1075.
Hennings, R. T., 424
Henrici, E., 842, 1049
Henriques, R , 813
Henriques, V., 674
Henry, A. J , 31, 222 322, 429, 430 620, 622, 819, 912.
Henry, E , 718.
Henry, G., 489.
Henry, H., 941.
Henry, L., 220, 1048.
Henry, R., 712
Henry, W. A , 229, 284, 490, 571.
Herbert, 848
Herdman, W. A , 426.
Hérissey, H , 511, 906, 1056.
Hermann, B , 854
Héron, G., 648, 1049
Herrick, G. W., 272.
Herring, F 704.
Hersey, E , 458.
Herzfelder, A. D , 419.
Herzog, W., 712, 842
Hess, E. H , 438, 731.
Hess, W. H., 613.
Hett, P., 110.
Henbner, A., 587.
Heuppe, F., 125.
Henrgo, J. M., 861.
Heuzé, 444.
Hexamer, F. M., 400.
Heymons, R., 173.
Hibler, E. von, 194, 288.
Hickman, J. E., 398.
Hickman, J. F., 162, 234, 257.
Hicks, G. H., 462.
Hiester, A. O., 298.
Higgins, C. H., 1092.
Higgins, J C., 999.
Higley, W , 1100.
Hilfreich, O., 93.
Hilgard, E. W., 406, 535, 717, 827.
Hilger, 614.
Hill, G. W., 497.
Hill, H. C., 457.
Hill, R. T., 853.
Hill, W. A., 1098.
Hilleary, W. M., 1098.
Hillman, F. H., 158.
Hills, J. L., 188, 307, 313, 328, 336, 381, 382, 383, 384, 385, 389, 406, 437, 482, 587, 983.
Hiltner, L., 318, 500, 1013, 1016.
Hiltner, R. S., 297.
Hine, J. S , 956.
Hitchcock, A. S., 121, 199, 420, 857, 927, 1047.
Hitchcock, F. H., 198, 296, 497.
Hite, B. H., 34, 239, 313, 438, 583.
Hitt, R. R , 690.
Hittcher, 1085.
Hobson, J., 451, 649.
Hockhauf, J , 166, 482.
Hodson, F. W., 198.
Hoff J. H. van't, 704.
Hoffding, O., 762.
Hoffmann, J., 428.
Hoffmann, L., 184.
Hoffmann, M., 125.
Hoffmeister, W., 1004
Hoft, H., 789.
Hogan, L. E., 79
Hohn, G., 153.
Hoitsema, C., 813.
Holdefleiss, F , 479, 828.
Holdefleiss, P., 1029.
Holden, P G , 1097.
Holland, W. J , 172.
Holleman, A. F., 310.
Holley, C. D., 1097.
Hollis, F S., 111
Hollrung, M., 468, 500, 959, 1057, 1060, 1061.
Holmerz, C. G. G , 747.
Holmes, E. S., jr., 698.
Holmes, M. C., 429.
Holmes-Pegler, H. S., 587
Holt, A. M., 1035.
Holter, G L , 100, 223, 277.
Holtermann, R F , 652.
Holtzman, K M., 1090
Homen, T , 132.
Hommell, R , 369.
Honig, M., 705.
Hood, F., 577, 937.
Hood, O. P., 197.
Hooper, C. H., 167, 451.
Hooper, D., 1063.

Hoopes, J., 910.
Hopkins, A. D., 220, 475, 768, 1100.
Hopkins, A. G., 898.
Hopkins, C. G., 199, 420, 633, 643, 1097.
Hopkins, J. H., 620.
Hoppe, 718.
Hornberger, R., 619.
Hornsby, J., 461.
Hoskins, C. E., 399.
Hotter, E., 109, 133, 138, 157, 229.
Houdaille, F., 128, 129, 590.
Hough, G. de N., 1065.
House, J. C., 353.
Houston, D., 326.
Howard, E. H., 971.
Howard, G. E., 291.
Howard, L. O., 168, 265, 370, 399, 471, 561, 950, 951, 1009, 1100.
Howe, J. L., 1100.
Hoxie, S., 284.
Huber, J. C., 764.
Hull, G. S., 926.
Hume, H. H., 297, 361.
Humphrey, A. G., 714.
Hunter, S. J., 265.
Hunter, W., 199.
Hunter, W. D., 563.
Huntley, F. A., 351.
Hurst, C. C., 52.
Husmann, G., 452.
Huston, H. A., 236, 438, 831.
Huston, J. D., 298.
Hutcheon, D., 91, 191, 289, 493, 494, 593.
Hutcheson, A., 296.
Hutchins, D. E., 1051.
Hutchinson, W., 790.
Hutchinson, W. L., 328, 397, 1069.
Hutchison, W. A., 298.
Hutson, W. F., 94.
Hutt, H. L., 547, 644, 650.
Hutton, F. W., 766
Hutyra, F., 793.
Hyams, C. W., 200, 909.
Hyatt, R. J., 126
Hyde, D. D., 883
Hyde, F. S., 307
Hyde, H. S. J., 1100.
Hyde, J., 41, 397, 698, 898.
Ibbotson, F., 813.
Ihering, H. von, 476.
Imbert, H., 813
Imes, M., 288.
Indemans, W. G., 888.
Insfran, F., 275.
Irby, B., 200.
Irwin, H., 598.
Isachenko, B., 123.
Istrati, C., 112, 904.
Ivanov, L., 894.
Iwanoff, K. S., 464.
Jablonowski, J., 174, 429.
Jackson, D. D., 813.
Jacky, E., 468, 949.
Jacobi, B., 320.
Jacquemin, G., 125.
Jaeger, H., 592.
Jaffa, M. E., 636.
Jager, L. de, 184.
Jans, M., 644.
Janse, J. M., 121, 500.
Jarvis, L. G., 670.
Javillier, 906.
Jaurand, 750.
Jean, F., 21.
Jeffery, J. A., 299, 520, 521.
Jemma, 882.
Jenkins, E. H., 540, 600, 719, 722, 730, 748, 750, 927.
Jenman, G. S., 249, 1038.
Jennings, T. B., 126.
Jensen, O., 980.
Jernström, J., 97.
Jess, P., 191, 493.
Jessen-Hansen, 614.
Jodin, V., 855.
Joffre, J., 436.
Johannsen, W., 633.
Johne, H. A., 594, 1092.
Johnson, A. C., 941.
Johnson, A. N., 799.
Johnson, J. M., 483, 1078.
Johnson, S. W., 600, 719.
Johnson, T., 948.
Johnson, W. G., 871, 951, 952, 953, 1009, 1099, 1100.
Johnston, C. T., 798.
Johnston, F. S., 200.
Johnston, J. H., 312.
Jokisch, C., 758.
Jokisch, E., 861.
Jolles, A., 380.
Jolyet, A., 455, 855.
Jones, A. B., 251.
Jones, C. H., 307, 313, 328, 336, 381, 437.
Jones, D., 66, 240, 442.
Jones, L. C., 112.
Jones, L. R., 56, 318, 353, 354, 355, 861.
Jones, S. C., 1091.
Jones, W. J., 438.
Jonesen, D. G., 175.
Jonsson, B., 460.
Jordan, A. T., 51, 735, 1039.
Jordan, E. O., 125
Jordan, W. H., 188, 235, 241, 295, 599.
Jörensen, S. P. L., 22.
Jörgensen, A., 125.
Jörgensen, G., 619.
Josst, F., 154.
Jost, H., 696.
Jourissen, 328.
Juckenack, A., 672, 882.
Judd, S. D., 425.
Juel, H. O., 167, 949.
Jules, F., 173.
Julhiard, A. M., 1056.
Junge, 154.
Jurass, P., 353.
Juritz, C. F., 214, 314, 328, 823, 824.
Kabitz, H., 290.
Kablukov, I. A., 475.
Kachinski, I., 894.
Kaehler, M., 112.
Kahlenberg, L., 1100.
Kains, M. G., 547, 937.
Kalanter, A. A., 86.
Kales, J. W., 819.
Karamzin, D., 765.
Karaulof, F. V., 91.
Karlinski, J., 93, 797.
Kasparek, T., 797, 894.
Kästenbaum, H., 591.
Katsuyama, K., 778.
Kawara, J., 173.
Kayser, R., 380.
Kebler, L. F., 310.
Kedzie, R. C., 30, 204, 208, 528, 842, 1018.
Keegan, P. A., 29.
Keffer, C. A., 398, 1045.
Kellner, O., 704, 770.
Kellogg, A. L., 199, 424.
Kelly, F. G., 200.
Kempner, W., 193, 678, 679.
Kennedy, P. B., 423, 800, 927, 1033.
Kenyon, C. F., 438, 627.
Kerby, J. C., 1000.
Kerr, J. G., 699.
Kerr, J. W., 899, 1098.
Kesler, G. C., 495.
Kikkawa, S., 100.
Kilgore, B. W., 39, 200, 206, 208, 209, 229, 294, 397, 528.
Killebrew, J. B., 927.
Kimball, H. H., 620.
King, F. H., 186, 489, 490, 517, 520, 521, 523, 537, 826, 1095.
King, H. E., 200.
Kinney, A., 941.
Kinney, L. F., 249.
Kinnicut, L. P., 1100.
Kinsley, A. T., 699.
Kinzel, W., 1056.
Kirchner, O., 370, 1037, 1055.
Kitchner, W., 284.
Kirk, T. W., 818, 842, 857, 858, 861, 870, 1064.
Kirkland, A. H., 560, 951, 954, 959, 1100.
Kirsche, A., 44, 1038.
Kisskalt, K., 279.
Kitt, T., 796.
Kittlausz, K., 146, 361, 538.
Kizenkov, S., 498.
Kjärsgaard, K. P., 781.
Kjerrulf, G., 91.
Klavieter, A., 697.
Klebahn, H., 59, 360.
Kleine, F. K., 483.
Kleptzov, K. Z., 589, 892, 895.
Klimmer, M., 592, 983.
Klinge, J., 159.
Kloepfer, E., 121, 1037.
Klyuchnikov, V., 747.
Knaup, 484.
Knauthe, K., 133.
Knight, N., 812.

Knopfelmacher, W., 21.
Knox, W. H., 142.
Kny, L., 320.
Kob & Co., C., 814.
Kobus, J. D., 241, 622, 734.
Koch, 192.
Koch, A., 262.
Koch, E., 998.
Koch, H., 1047.
Kolbe, H. J., 767.
Kolbe, W., 656.
Kolkwitz, R., 917.
Kolle, W., 88, 593.
Kollock, L. G., 510.
Kolpakov, V., 895.
Kommick, F., 87.
König, J., 506, 644.
Köning, C. J., 358.
Koningh, L. de, 211.
Koorevaar, P., 272.
Kopezky, R., 515.
Köppen, 432.
Korff, G., 122.
Korn, O., 387.
Körner, 795.
Korsak, D., 893.
Kóssa, J. von, 483.
Kotlubai, G., 894.
Kourinsky, L., 145.
Kovalevski, I. N., 893.
Kozai, Y., 489, 789.
Kraemer, H., 211.
Kraevski, A., 895, 896.
Kravkov, S., 623.
Kredba, P. V., 1092.
Krichauff, F. E. H. W., 733.
Kriese, J., 242.
Kromayer, E., 393.
Kruch, O., 116.
Krüger, 465.
Krüger, L., 764.
Kruger, R. T., 706.
Krüger, W., 32, 711, 830, 1016.
Krukov, N. A., 197.
Krüsemann, A., 843.
Kübler, 695.
Kühn, J., 300.
Kühnam, M., 593.
Kuhnert, 443.
Kulagin, N., 271.
Kulczycki, W., 896.
Künckel d'Herculais, J., 172, 913.
Künnemann, 381.
Kusano, S., 910.
Küster, E., 221.
Kuwahara, T., 778.
Laborde, J., 715.
Lacerde, J. B. de, 192.
Ladd, E. F., 214, 218, 224, 228, 241, 279, 287, 812, 821, 823, 1099.
Lafosse, G., 861.
Lagerheim, G., 861, 562, 564.
Lahache, 223.
Laighton, M. O., 1083.
Laitor, C. U., 1038.
Lallemant, E., 56, 511.
Lam, A., 587.
Lamb, F. H., 940.
Lambert, F., 65.
Lambert, R. P., 1063.
Lambillion, L. J., 767.
Lambott, E., 393.
Laméris, J. F., 795.
Lampa, S., 66, 564, 765.
Lamson, H. H., 153, 255.
Lancaster, A., 128, 621.
Lander, B., 477.
Landes, G., 250.
Landsteiner, K., 292.
Lane, C. B., 188, 783, 883.
Laney, C. C., 852.
Lanfrey, 658.
Lang, A., 643.
Langdon, W. C., 298, 600, 889.
Lange, 125.
Langley, C., 297.
Langworthy, C. F., 184, 777.
Lannelongue, 193
Larsen, B., 56.
Lasne, H., 104, 723.
Latta, W. C., 335, 540.
Lauck, H., 29.
Lauman, G. N., 49.
Laurent, A., 759.
Laurent, E., 550.
Lauvitsen, L. P., 259.
Laveran, A., 291, 797.
Laxa, O., 980.
Laxton Bros., 352.
Law, J., 495.
Lawes, J. B., 444, 732.
Lawrence, W. T., 1088.
Lazenby, W. R., 252, 309, 457, 706, 851, 956.
Lea, A. M., 563, 957.
Leach, A. E., 672.
Leavitt, R. G., 424.
Lebbin, G., 672.
Lebell, J., 1092.
Leblanc, P., 191, 288, 895.
Lebrun, O., 895.
Leclainche, E., 191, 290, 697, 996.
Leclerc, A., 1038.
Leclerc du Sablon, 216, 321.
Lecocq, E., 213.
Lecomte, H., 851, 1049, 1065.
Leddy, M. A., 199.
Leedy, B. G., 1098.
Leffmann, 705.
Legge, T. M., 92.
Lehmann, K. B., 786.
Lehmann, M., 700.
Lehmann, O., 1016.
Lehner, V., 312.
Leichtenstern, 793.
Leipziger, R., 778.
Leisenring, O. D., 818.
Leistikow, 696, 1075.
Leithiger, 42.
Lelong, B. M., 414.
Lemcke, H., 1048.
Lemmermann, O., 134.
Lemoine, A., 214.
Lengowski, F., 87.
Leonard, N., 213, 705.
Leonardi, G., 274, 1065, 1066.
Leoni, A. M., 229.
Lépine, R., 1076.
Le Roy, G. A., 905.
Lesbre, 285.
Leslie, W., 500.
Less, E., 821.
Letellier, A., 907.
Leven, G., 262.
Leverett, F., 1094.
Levy, E., 494.
Lewadowsky, M., 778, 892.
Lewin, L., 112.
Lewis, J., 526.
Lewis, L. L., 386, 391, 1090.
Lewkowitsch, J., 705, 811.
Ley, H., 614.
Leyden, E. von, 380.
Leys, A., 418, 904, 984.
Lézé, R., 904.
Libby, O. G., 620.
Lidforss, B., 319.
Liebener, 191.
Liebreich, O., 962.
Liefeld, E. T., 855.
Lie-Petterson, O. J., 174.
Liggett, W. M., 397, 408.
Lindau, G., 67.
Lindsey, J. B., 566, 568, 576, 577, 587, 777.
Linebarger, C. E., 112
Linney, C. E., 127.
Linsbauer, K., 319.
Lintner, C., 800.
Lintner, C. J., 22.
List, E., 882.
Litchfield, H. C., 798.
Lloyd, C. G., 709.
Lloyd, E. R., 1068, 1072, 1084.
Lloyd, F. J., 282, 689.
Lloyd-Baker, G. E., 588.
Lochhead, W., 651, 657.
Lochow, F. von, 144, 1038.
Loew, O., 194, 727, 814, 1008.
Löffler, F., 495, 694.
Lohmann, H., 958.
Loir, A., 294.
Lokot, T., 129.
Lomonosov, P., 45.
Lonay, A., 159.
Look, 882.
Loop, C. F., 1097.
Lop, P. A., 193.
López y Parra, R., 576, 649, 926.
Loren, 457.
Lotzy, J., 121.
Louchnik, N., 778.
Loughridge, R. H., 410.
Lounsbury, C. P., 470, 759, 763, 1065, 1100.
Loveland, G. A., 127.
Lovell, J. H., 870.
Low, A., 442.
Lowe, V. H., 63, 66, 170, 173, 865, 871.
Lubanski, F., 198, 643.

Lucet, A., 299.
Lucion, R., 311.
Luckhurst, E., 744.
Ludwig, F., 28.
Luedecke, C., 826.
Luehmann, J. G., 458.
Lugger, O., 170, 361, 468, 861, 864.
Lührig, H., 659, 660.
Lukens, T. P., 455
Lumia, C., 125.
Lunde, H. P., 887.
Lundgren, J., 495, 591.
Lundin, K. F., 490, 790.
Lunge, G., 112.
Lutz, L., 316, 700.
Luxmoore, C. M., 327.
Lyashchenko, P., 628.
Lyman, C. E., 877.
Lyno, J , 1007.
Lyon, T. L., 200, 240, 270, 839, 1030.
Lyon, T. T., 252, 800.
Lyons, C. J., 429, 620.
Lyons, P. F., 127.
Lyudskanov, S., 997.
McAdie, A. G., 126, 127, 322, 409.
McAlister, J. A., 900.
McAlpine, A. N., 1028.
McAlpine, D., 214, 821, 659
McBryde, J. B., 149, 298, 299.
McCalvé, J , 394.
McCarthy, G., 659.
McClatchie, A. J., 236, 239, 414, 714, 833, 847, 850, 855, 888.
McConnell, P , 285.
McCue, J J., 80.
McCulloch, C., 190, 495, 1091.
McCurdy, C. W., 313, 327, 340, 398.
McCurdy, F. C., 592.
McDonnell, H B., 229, 527, 528
McDonnell, M. E , 83, 298.
McDowell, J. S., 109.
McEachran, D., 592, 694.
McFadyean, J., 92, 190, 194, 291, 394.
McGann, E. W., 127.
McGill, A., 672
McKay, A. B., 241, 415.
McKay, G. L., 285, 984.
McKeen, B. W., 971
McKellar, H., 766.
McKenna, C. F., 1100.
McKenney, R. E. B., 818.
McLaren, J., 435.
McMurtrie, W., 1100.
McNeely, J. T., 972.
McWeeney, E. J., 948.
MacBride, T. H., 515.
Macdonald, A. C., 444.
Macdonald, G. U., 457.
MacDougal, D. T., 24, 28.
Macdougald, G. D., 313, 1084.
MacDougall, R. S., 168, 263, 272, 424.
MacDowall, A. B., 31.
Macfarlane, J. M., 818.
Macfarlane, T., 672.
Mackay, A., 830, 831, 850, 858, 876, 894.
Mackenzie, W. C., 135, 437.
MacKinlay, G., 251.
MacLeod, J. J. R., 778.
Macmillan, C., 1014.
Macoun, W. T., 547, 548, 844, 942.
MacOwan, P., 556.
MacPherson, D. M.. 490.
Macqueen, J., 291.
Madsen, S., 789.
Madsen, T., 694.
Maercker, M., 331, 505.
Maffucci, 592.
Magnus, P., 261, 322, 948, 949.
Magruder, W. T., 415.
Maiden, J. H., 220, 355, 858, 894, 1015, 1052.
Maillard, L., 814.
Maire, R., 1015.
Maizières, 39, 138, 228, 229, 230, 528, 529, 917.
Majstorović, R., 481, 813.
Makarov, O., 894.
Malet, F., 444.
Mallarian, C. H., 200.
Mallet, J. W., 374, 510, 813.
Mallett, G. B., 165, 478, 947.
Malley, F. W , 273
Mally, C. W., 62, 499, 871, 952.
Malméjac, F., 526.
Malpeaux, L., 136.
Maltzev, M. A., 592.
Malvoz, E., 493.
Mancini, C., 842.
Manfredi, L., 90, 995.
Mangin, L., 860, 948.
Manley, J J , 434.
Mann, K., 90, 661, 672.
Mansfield, E R., 99, 928.
Mansholt, J. H., 442, 539.
Manson, M., 319, 747.
Maquenne, L , 20, 55, 1056.
Maragliano, E . 795.
Marbury, J. B , 127
Marchal, P., 958.
Marchlewski, L , 510, 710, 814.
Marcus, E., 706.
Marcuse, J., 183.
Marean, R. B., 620.
Maréchal, 393.
Marg, A. P., 443.
Mari, N. N., 893, 895.
Marie, C , 1007.
Marie-Davy, 32.
Marion, J. H , 650.
Markevich, O. I., 594.
Marks, 797.
Marlatt, C. L., 265, 274, 950, 951, 952, 953.
Marmier, 133.
Marneffe, G. de, 80.
Marpman, G., 33.
Marre, E , 135, 540, 1037.
Marsac, 888.
Marshall, A., 310, 313.
Marshall, C., 299.
Marshall, C. E., 295, 390, 1065.
Marshall, W., 427.
Martin, C., 1035.
Martin, H. T., 453.
Martinet, G., 184.
Martini, 112.
Martinotti, F., 112.
Marvin, C. F., 228, 432, 621, 819.
Mascart, 1000.
Mascart, E., 311.
Mason, S. C., 938.
Mason, W. P., 312.
Massalongo, C., 1065.
Massart, M. J., 116.
Massee, G., 167, 360, 362, 460, 555, 1060.
Massey, W. F., 153, 497, 1047.
Masson, 526.
Massone, A., 688.
Mastbaum, H., 593.
Mathis, 192.
Mathison, F. R., 52.
Matrion, 191.
Matsumura, M., 470.
Mattirolo, O., 275.
Matvyeev, V., 895.
Matzuschita, T., 287, 593.
Maughan, P. W., 900.
Maumené, E., 293.
Maurizio, A., 906.
Mawley, E., 649, 911.
Maxwell, H., 194.
Maxwell, R., 649.
Maxwell, W., 497, 507.
May, W., 657.
Mayer, A., 23, 310.
Mayer, C., 852.
Mayer, E., 759.
Mayer, G., 694.
Mayet, V., 658, 765, 767, 871.
Maynard, H. L., 699.
Maynard, S. T., 174, 477, 543, 852.
Mazé, 218, 317, 1015.
Mazhdrakov, T., 1091.
Mazza, C., 478, 495.
Mead, C. E., 499, 767.
Mead, E., 95, 96, 204, 407, 412, 798, 1094.
Means, T. H., 131, 133, 434, 729, 912.
Meehan, J., 154.
Meehan, T., 121, 398, 400, 910.
Meek, A., 494.
Meillère, G., 419.
Meissner, P., 93.
Melick, W. S., 940.
Mell, P. H., 145, 154.
Mendez, J., 795.
Mer, E., 28.
Mercanti, F., 997.
Mercier, F., 92.
Meredith, V. C., 397.
Merriam, C. H., 428.
Merrifield, F., 870.
Merrill, L. A., 663, 1091.

Merrill, L. H., 912, 959, 960.
Merrill, M. W., 960.
Meshchadimenko, M. T., 893.
Mestre, C., 174.
Metchnikoff, E., 794.
Meuleman, E., 128.
Meulenaere, O. de, 52.
Meyer, C., 87.
Meyer, F. W., 650.
Meyer, W., 515.
Meyerhoffer, W., 704.
Mez, C., 133.
Michaelsen, W., 429.
Michelsen, H., 458.
Michon, J., 658.
Middleton, T. H., 140.
Miles, E. H., 882.
Millardet, A., 262.
Miller, D. B., 850.
Miller, W., 650.
Mills, A. T., 200.
Minden, M. von, 424.
Mingaye, J C. H., 230.
Mislin, A. E., 443.
Mitchell, A. J , 127.
Mitchell, A. S., 872.
Mitchell, G. A., 440
Mitchell, R. B., 200, 297
Mitchell, W. L., 297, 777
Mitscherlich, A., 1022.
Miyabe, K , 910
Mlodziansky, A. K., 747.
Moerk, F. X., 112
Mohr, C., 59, 556.
Mokrzhetzki, S. A., 371, 478, 563, 565.
Molenda, O., 905
Möller, E., 81, 86
Molliard, M., 910.
Momsen, C., 1081.
Monahan, A C., 128, 222, 432, 715.
Mongour, 394.
Monnot, C., 381.
Monrad, J. H., 490, 976.
Montemartini, L., 221, 261
Montgomery, T. H., 428.
Monvoisin, A., 489.
Mooers, C. A., 298, 903.
Moore, A. L., 1097.
Moore, H. F., 1038.
Moore, J. S., 253, 821, 1079, 1080
Moore, V. A., 290, 291, 492
Moore, W. L , 126, 223, 397, 431, 621.
Morachevsky, V., 658
Morard, M. G., 194.
Moreigue, H , 813.
Morel, C., 697.
Moreno, P., 298.
Moreno y Anda, 31.
Morgan, H. A., 588.
Morgenroth, 790
Morini, U., 905.
Mörner, C. T., 706.
Morot, 289.
Morozov, G. F., 434.
Morpurgo, B., 695.
Morpurgo, G., 26, 514.
Morrill, R., 861.
Morris, D., 101.
Morris, O. M., 929.
Morris, R. C., 195.
Morrow, G. E., 99, 1002, 1036, 1069.
Morse, F. W., 138, 178.
Morse, W. J , 318.
Morselli, R., 694.
Mosley, S. L., 1065.
Mosselman, 191.
Mossman, R. C., 517.
Moszeik, O., 341.
Mouillefert, P., 942.
Moussu, G., 1091.
Mueller, T., 299.
Muir, J., 438
Muller, F., 496, 862.
Muller, J , 290.
Müller-Thurgau, H., 320, 932.
Muller von Berneck, R., 706.
Muller, W., 428.
Mumford, H. W., 99.
Muncy, V. E., 323.
Munk, I , 778.
Munson, L. S., 528.
Munson, T. V., 399, 650.
Munson, W M , 153, 262, 399, 709, 908, 909, 928, 929, 931, 1099.
Muntz, A., 449, 576.
Murkland, C. S., 406.
Murray, J. A., 140
Musgrave, J S., 699.
Muskett, P. E., 278.
Mut, D. J., 892.
Mutschler, L., 213, 312
Muttrich, 718
Myers, J. A., 331.
Myrick, H., 476.
Myrsten, C. J., 97
Nabokich, A., 710
Nadson, G. A., 555.
Nagel, 658.
Nagle, J. C., 415.
Nash, G. V., 1037.
Nastukov, A., 126.
Naudin, C., 27, 300.
Navarro, L., 125.
Neale, A. T., 141, 185, 189.
Nedokuchaev, N. K , 636.
Needham, J. G., 562
Neff, J B., 453
Nelson, A., 53.
Nelson, E., 1015.
Nelson, E. W., 428.
Nelson, J., 125, 714, 791.
Nelson, S. B , 997.
Nerking, J., 419.
Ness, H., 120, 247, 499.
Nessler, 167.
Nestler, A., 321.
Neubauer, H., 311.
Neumann, A., 705.
Neumann, R. O., 380, 778.
Newcombe, F. C., 124.
Newell, F. H., 94, 196, 798.
Newell, W., 499, 657, 958.
Newman, C. C., 298, 1096.
Newman, C. L., 242.
Newman, G., 714.
Newman, J. S., 439, 834, 835.
Newport, H., 744, 1048.
Newstead, R., 765.
Nicholson, H. H., 839.
Nicolle, 192, 289, 797.
Nicotra, L., 113.
Nielsen, H. P , 500.
Niles, E. P., 173, 191, 288, 494, 1074.
Niles, W. B., 290.
Nilson, E., 942.
Nilson, L. F., 86, 331.
Nilsson, N. H., 241.
Nisbet, J., 942, 1052.
Niven, J., 193.
Noack, F., 59, 260, 644
Noack, O. G., 192.
Nobbe, F., 318.
Nocard, 796, 894, 1091, 1092
Noe, G., 957
Noll, A. F., 1052
Nomura, H., 67.
Nordhausen, M., 322.
Nörgaard, V. A., 491, 991.
Nösske, H., 694.
Notarnicola, N., 494
Nourse, D. O., 183, 925
Novalbos y Balbuena, E., 92.
Növik, P., 198.
Novy, F. G., 125, 509, 511, 715.
Nowacki, A., 826.
Nowoczek, A., 56
Noyes, G. H., 127.
Nusslin, O., 564
Nuttall, G. H. F., 92, 561, 925.
Nuvoli, R., 138.
Nyemetz, Y., 50, 152
Nypels, P., 167, 458, 950.
Nys, A., 1047.
Nystedt, S., 91, 1091.
Oeberg, K., 972
Oettinger, G., 112, 904.
Offer, T. R., 672.
Ogden, A. W., 777.
Oger, A., 744.
Oliver, G W , 152
Ollendorff, G , 905.
Olwell, J. T., 1098.
Omelianski, V., 424, 711, 827.
Omnis, 250
Omori, J , 949
Ono, N., 910.
Orr, W M , 167
Orton, W. A , 100, 318, 353, 354, 355, 361.
Osborn, H., 476, 766, 1064
Osborne, T. B , 309, 310, 705.
O'Shaughnessy, F R., 213.
Osterspey, 145.
Ostertag, 193, 279, 494, 678, 679.
Osterwalder, A., 1061.
Ostrander, J. E., 128, 222, 432, 715.
Otis, D. H , 199, 487, 1037.
Ototzki, P. V., 32, 434, 718, 826.
Ott, E., 511.

Ottavi, E., 323.
Otto, R., 51, 646, 851.
Outram, T. S., 126.
Ouvray, E., 166.
Overton, E., 113, 121.
Owens, R., 285.
Paddock, W., 49, 52, 172.
Pagliani, L., 478.
Pagnoul, A., 32, 118, 331, 815, 822.
Pague, B. S., 126, 128, 430, 622, 1098.
Paher, E., 540.
Paige, J. B., 591, 998.
Palladin, W., 421, 515, 707.
Palmer, T. S., 425.
Pammel, L. H., 319, 355, 407, 651, 709, 714, 1099.
Pannwitz, K., 175.
Panzer, T., 618.
Paris, G., 813.
Park, A., 995.
Parker, R., 548.
Parmelee, C. L., 312.
Paroissien, P., 469.
Parrott, P. J., 171, 200, 274, 1066.
Parry, E. J., 618.
Parsons, S., jr., 852.
Parthiel, A., 618.
Paspelow, W., 476
Passerini, N., 715
Passy, L., 547.
Passy, P., 261, 273.
Paterson, J. W., 332, 876, 1028, 1071.
Patten, A. J., 1097.
Patten, C. G., 399.
Patterson, H. J. 140.
Patterson, J. K., 407.
Paulcke, W., 657.
Payne, J. E., 323, 339.
Peacock, R. W., 1038.
Pearson, A. N., 228, 1038.
Pearson, L., 591, 696, 995.
Pearson, R. A, 984.
Peck, C. R., 370.
Pécus, 191.
Peglion, V., 126, 362.
Pellerin, 882.
Pellet, H., 213, 443, 509.
Pellissier, J, 331.
Peneveyre, F., 476.
Pennell, A., 127.
Penny, C. L., 141, 485.
Pepin, 51.
Pepper, F. F., 84.
Perez, C., 870.
Perez, G., 995.
Pergande, T., 871.
Perkins, A. G., 511.
Perkins, A. J., 273.
Perkins, W. R., 1022, 1068.
Pernter, J M., 323.
Perraud, J, 262, 358, 871.
Perroncito, E, 592.
Perry, T. O., 195.
Peter, 493.
Peter, A. M., 314, 627.
Petermann, A., 79, 284, 497, 1026.
Peters, A., 1087.
Peters, A. T., 393, 697.
Petersen, P. V. F., 887.
Petersen, T., 167, 556.
Petropavlovski, Y. N., 896.
Petrunkewitsch, A., 767.
Pettee, C. H., 128.
Petterson, O., 223.
Pettit, L. H., 996.
Pettit, R. H., 954, 957.
Peyron, J., 66.
Pfeiffer, R., 694.
Pfeiffer, T., 87, 134, 281, 380, 506, 831.
Pflüger, E., 22, 419, 883.
Pfuhl, E., 393.
Phelps, C. S., 539, 723, 819, 835, 873, 877, 890.
Phillips, J. L., 455.
Phillips, W. F. R., 30, 221, 222.
Phisalix, C., 201.
Pichard, P., 132.
Pickel, J. M., 984.
Piercy, J. C., 127.
Pierre, L., 744.
Pieters, A. J., 408, 748.
Pike, N., 747.
Pillans, E., 651.
Pillsbury, J. P., 452.
Pinart, A. L., 451.
Pinchot, A. R., 900.
Pinchot, G., 454, 457, 745, 855, 900, 938.
Pinchot, J. W., 900.
Pincot, R., 172, 657.
Pindell, L. M., 126.
Piper, C. V., 1055.
Pitsch, O., 144.
Pittuck, B. C., 233, 438.
Planitz, A von der, 758.
Plehn, B., 888.
Plimmer, H. G., 91, 592.
Plotti, G. B., 796.
Plowright, C. B., 262, 467, 949
Plumb, C. S., 191, 219, 285, 300, 667.
Poda, E., 183.
Podvuisotzki, V. V., 893.
Pogson, F., 184.
Poirault, G., 300.
Poisson, 1049.
Polak, K., 958.
Polferov, Y., 893.
Pollacci, G., 1015.
Polovtsov, V., 816.
Polyakov, D., 896.
Pomeroy, N., 1049.
Pommer, 361.
Pompeu, J. B., 166.
Pons, J., 172.
Ponsot, A., 419.
Popenoe, E. A., 199, 272.
Poppleton, O. O., 271.
Poquillon, F., 903.
Porchinski, I., 653.
Posner, C., 672.
Potapenko, I. N., 896.
Potel, H., 871.
Potter, A. T., 767.
Potter, M. C., 1061.
Pottevin, H., 511, 706, 715.
Pouget, 618.
Poulton, E. B., 870.
Pound, C. J., 91, 695, 796, 1086.
Pouret, 618.
Pouriewitsch, C., 221.
Pourriau, A., 1085.
Powell, G. H., 362, 399, 453, 473 563, 845, 937.
Powell, G. T., 900.
Power, T. C., 1092.
Pozzi-Escott, M. E., 509.
Pradel, C., 1026.
Pradel, E. C., 351.
Prantner, J., 67.
Prasse, H., 697.
Preble, E. A., 429.
Pregl, F., 419.
Preisz, H., 797.
Prettner, M., 594, 1092.
Preusse, 893.
Preyer, A., 1056.
Prianishnikov, D. N., 321, 527.
Price, H. L., 128, 851.
Price, R. H., 247, 1048.
Price, T. M., 297.
Price, W. B., 699.
Priego, J. M., 443.
Prillieux, 700, 871.
Primrose, H. W., 278, 600, 960.
Prince, L. B., 298
Prinsen-Geerligs, H. C., 146, 905, 911.
Prior, E., 420.
Prost, 328.
Prunet, A., 260, 357, 362, 758.
Pukhalski, Z. G., 1091.
Puriewitsch, K., 322.
Pybus, G. E., 442.
Pynaert, E., 262.
Pynaert, L., 469.
Quaintance, A. L., 864, 952, 1100.
Quajat, E., 870.
Quincey, Z., 340.
Quinn, G., 548, 650, 1047.
Rabinowitsch, L., 193, 678, 679.
Rablaud, E., 577.
Raciborski, M., 146.
Radais, 465, 949.
Rafter, G. W., 1093, 1094.
Ragan, W. H., 400.
Raikow, P. N., 619.
Railliet, A., 92, 429.
Rallo y Campuzano, J., 843.
Ramaley, F., 28.
Ramann, E., 910.
Ramm, E., 81, 86, 483, 885.
Ramond, F., 394.
Ramos, A., 192.
Rane, F. W., 140, 145, 146, 147, 152, 153, 159, 235, 707.
Ranina, S. N., 1090.
Rankin, J. M., 61, 1062.
Ransom, A. McB., 297.

Rapp, R., 713.
Rasetti, G. E., 28, 888.
Rathay, E., 759.
Rathbun, M. J., 428.
Ratoin, E., 851.
Rátz, S. von, 697, 797.
Raudnitz, R. W., 874.
Ravant, P., 394.
Ravaz, L., 52, 122, 167.
Ravenel, M. P., 193.
Rawlings, T., 499.
Raymond, J. H., 415.
Reakes, C. J., 995.
Redding, R. J., 30, 39, 138, 841, 1018, 1030.
Reed, J. H., 693, 997.
Réfik-Bey, 593.
Regenbogen, 870.
Regner, G., 194, 494, 795.
Reh, L., 563, 655, 657.
Reichenbach, H., 696.
Reid, H. F., 799.
Reinhardt, O., 1015.
Reinhart, N. E., 494.
Reinke, J., 710.
Reinsch, A., 905.
Reitmair, O., 34.
Remy, 193.
Remy, T., 240, 531, 643.
Rennie, W., 642, 672.
Repiquet, 289.
Repp, J. J., 199.
Reul, A., 592.
Reusch, H., 744.
Reuter, E., 765.
Reuter, M., 1085.
Reynolds, J. B., 621, 622, 625, 687, 999.
Reynolds, M. H., 1092.
Rey-Pailhade, J. de, 1076.
Rhodin, S., 39, 625, 710, 734.
Rich, E. C., 499.
Richards, E. A., 183.
Richards, T. W., 313.
Richardson, H. P., 297.
Richmond, H. D., 213, 281, 618
Rideal, S., 582.
Ridgaway, C. B., 1017, 1022.
Riegler, E., 214.
Rigaux, E., 888.
Rigaux, F., 883.
Rim, T. R., 1051.
Rimbach, A., 320.
Rimpau, W., 540.
Ringelmann, M., 526.
Ritland, N., 81.
Ritzema-Bos, J., 175, 562, 1065, 1066.
Rivors, T. F., 300.
Riviere, C., 540.
Robb, D., 688.
Roberthan, G. A., 398.
Roberts, I. P., 1099.
Roberts, J. A., 1097.
Roberts, W. J., 1094.
Robertson, J. W., 547.
Robertson, R., 820, 831, 885.
Robertson, S., 23.
Robertson, W. W., 699.
Robin, M., 92.
Robinson, B. L., 121.
Robinson, J. T., 398.
Rocca, E., 651.
Rockafellow, B. F., 199.
Roder, 1092.
Rodet, A., 795.
Roe, R. S., 43, 44, 51, 97.
Roger, 192.
Roger, E., 31.
Rogóyski, C., 299, 435, 830.
Röhmann, F., 813.
Rolfe, G. W., 20.
Rolfs, P. H., 739.
Rolland, 547.
Rollins, G. B., 99.
Rollov, A. K., 252.
Rondelli, A., 489.
Rongger, N., 111.
Root, E. R., 870.
Rope, G. L., 429.
Roper, G. C. D., 644.
Rosa, E. B., 372, 576.
Rose, J. M., 428.
Rose, P. S., 600.
Rosemann, R., 184, 576, 973.
Rosenbusch, D., 795.
Rosengren, L. F., 87, 714.
Rosenheim, O., 661, 906.
Rosenkov, K. N., 477.
Rosier, C. H., 213.
Ross, B. B., 205, 292, 1026.
Rossinski, D., 764.
Rosso, 794.
Rost, E., 778.
Rostrup, E., 322.
Rostrup, O., 55.
Rotch, A. L., 1018.
Roth, F., 746.
Rothenbach, F., 715.
Rothert, W., 814.
Rothrock, J. T., 941.
Rouches, N., 193, 390.
Roux, 894.
Roux, E., 20.
Rowlee, W. W., 708.
Roy, E., 562.
Rozé, E., 273, 454.
Ruddick, J. A., 285, 1085.
Rudolph, J., 251.
Ruggeri, R., 23.
Ruff, O., 905.
Ruffin, A., 888.
Rullmann, W., 125.
Runyan, E. G., 205.
Russell, F. L., 987.
Russell, H. L., 125, 487, 517, 565, 578, 579, 580, 581, 986.
Russell, L. W., 937.
Ryan, F. G., 312.
Ryan, J. F., 699.
Ryan, J. J., 199.
Ryazhev, A., 896.
Ryley, A. M., 327.
Saass, C., 192.
Sabidussi, H., 222.
Sabrazès, 795.
Saccardo, P. A., 469.
Sage, J. R., 126.
Sagnier, H., 299, 334.
Saguier, C. R., 275.
Sajo, K., 173, 271, 272, 273, 274, 361, 425, 477.
Sakellario, D., 56.
Salisbury, G. N., 126, 127.
Salmon, D. E., 494, 594, 697.
Salmon, E., 658.
Salvandy, de, 547.
Samassa, P., 120.
Samborski, S., 896.
Samoggia, M., 44.
Samson, H. L., 420.
Sanchez, P. P., 288.
Sanderson, E. D., 62, 273, 297, 370, 477, 564, 1100.
Sannino, 52.
Santrucek, R., 957.
Sarce, C., 576.
Sargent, C. L., 824, 1003.
Sargent, F. L., 423, 970.
Sargent, G. W., 313.
Sasaki, C., 561.
Sata, A., 794.
Satterthwaite, J. M., 199.
Säuberlich, 145.
Saunders, D. A., 817.
Saunders, J., 909.
Saunders, R. G., 696.
Saunders, W. (Canada), 547, 831, 857, 874, 942.
Saunders, W. (U. S. D. A.), 451.
Savastano, L., 59.
Savigné, 895.
Saylor, C. F., 535.
Sayre D. B., 594.
Schacht, 241.
Schaternihon, U., 971.
Schattenfroh, A., 688.
Schaudinn, F., 658.
Schellenberg, H. C., 949.
Schellenberger, 871.
Schenck, F., 424.
Schenke, V., 508.
Schensnovich, S. L., 893
Scherpe, R., 619, 1036.
Schidrowitz, P., 661, 906.
Schillbach, H., 134.
Schilling, A., 643, 733.
Schindelmeiser, 705.
Schindler, 232.
Schipper, W. W., 1063.
Schively, A. F., 817.
Schlatholter, P., 193.
Schlegel, M., 191.
Schlicht, A., 1007.
Schloesing, T., 821.
Schloesing, T., jr., 131.
Schlossmann, A., 998.
Schmid, A., 1084.
Schmid, H., 1025.
Schmidt, H. M., 696.
Schmidt, J., 321.

Schmöger, M., 705.
Schmoldt, 371.
Schneidewind, W., 32, 711, 831, 1016.
Schöberl, L., 593.
Schou, C. V., 306.
Schoug, E., 796.
Schoultz, N., 321.
Schöyen, W. M., 66, 67, 765.
Schreiber, C., 520.
Schreiber, O., 93, 495, 895.
Schrenk, H. von, 1061.
Schribaux, E., 462, 750, 1057.
Schroeder, E. C., 991.
Schröter, C., 121.
Schrott, H., 889.
Schuard, E., 932
Schüle, 173.
Schulte, J. I., 300.
Schultz, F. N., 381.
Schulz, N., 483.
Schulze, B., 638, 888.
Schulze, E , 710, 1056.
Schumburg, 184.
Schütz, W., 195, 290.
Schuyler, J. D., 1052.
Schwan, O., 1061.
Schwappach, A., 458.
Schwarzkopf, O., 192.
Schweder, G., jr., 434.
Schweinitz, E. A. de, 8[illegible] 490, 987, 988, 996, 997.
Schweitzer, P., 1004, 1005, 1006, 1008, 1042, 1043, 1068, 1075, 1076.
Sclavo, A., 890.
Scott, A. B., 151.
Scott, A. C., 100.
Scott, W. M., 368, 953.
Scovell, M. A., 206, 627.
Scribner, F. Lamson, 28, 219, 423, 539, 709, 1015, 1032, 1033.
Scudder, S. H., 66, 371.
Sears, F. C., 959.
Sebelien, J., 229.
Sebor, 706.
Seelhorst, C. von, 923, 1037.
Seelye, C. W., 852.
Seifert, W., 126.
Seissl, J., 822.
Selby, A. D., 57, 142, 160, 162, 260, 356, 357, 415, 1046.
Selden, B. R., 299.
Sellergren, G. A., 240.
Sellier, 1056.
Semichon, L., 294.
Sempolowski, A , 26, 44, 1022
Sempolowski, L., 311.
Senderens, J. B., 759.
Sendtner, R., 882.
Senequier, R., 80.
Senn, C. H., 183.
Seno, K., 778.
Serafini, A., 998.
Seret, F., 87.
Serre, P., 564.
Sessions, H., 92.
Sessions, H. M., 241.
Sestini, F., 619.
Seurat, L. G., 174.
Seyda-Stettin, A., 23.
Shadrine, N. A., 594.
Sharp, D., 370.
Sharp, P. F., 199.
Sharp, T. H., 443.
Sharpe, B. F., 430, 622.
Sharpe, T. A., 831, 850.
Shattuck, R. A., 200.
Shavrov, N., 548
Shaw, G. W., 208, 446, 1034.
Shaw, R. H., 297.
Shaw, T., 175, 179, 184, 462, 587.
Shcherbarchev, V., 341.
Shchusev, S. V., 1022
Shepard, C. U., 741.
Shepard, J. H., 142.
Shepard, L. J., 800, 928, 929.
Shepperd, J. H., 325, 331, 338, 339, 779.
Sherman, H. C., 1100.
Shibata, K., 910.
Shinn, C. H., 636.
Shirai, M., 469, 861.
Shiver, F. S., 206, 918.
Shomaker, J., 145, 240, 294, 395, 898.
Shorey, E. C., 310.
Shreiner, Y., 66.
Shulov, I., 749.
Shutt, F. T., 462, 813, 816, 826, 827, 831, 873, 882, 1036.
Shuttleworth, A. C , 304.
Siegel, 92
Siegert, F., 889.
Siegfeld, M., 813, 886.
Silberberg, L. A., 892.
Silberschmidt, 797.
Simoes, [illegible], 493.
Simon, A., 453.
Simonet, F., 862.
Simons, A. J. J. B., 1022.
Simons, E. A., 818
Simons, F. D., 312.
Simpson, J., 748, 941.
Sims, A. F., 127
Sintenis, F., 272.
Sioussat, G. L., 799.
Sirrine, F. A., 257, 269, 273, 1065.
Sivén, V. O., 1067.
Sivori, F., 694, 696.
Sixt, E., 716.
Sjollema, B., 418.
Sjöstedt, Y., 66.
Skertchly, W P., 213.
Skinner, B. S., 298.
Skinner, H., 174.
Slichter, C. S., 519.
Slingerland, M. V., 173, 273, 368, 370, 476, 866, 1064.
Sloane, T. O'C., 511.
Slosson, E. E., 1053.
Smart, C., 882.
Smart, J. H , 800, 1001.
Smets, G., 831, 1025.
Smith, A. W., 770.
Smith, C. B., 769.
Smith, C. D., 43, 53, 168, 413, [illegible], 779, 842.
Smith, E. F., 944.
Smith, F. C., 548.
Smith, G. A., 889.
Smith, G. N., 715.
Smith, H. M., 213, 705.
Smith, J. B., 66, 371, 562, 760, 764, 868, 958.
Smith, J. G., 145, 219, 339, 341, 423, 709.
Smith, J. W., 126, 127, 430, 821.
Smith, L. H., 199.
Smith, R. E., 159, 257, 551.
Smith, R. H., 525.
Smith, Theobald, 93, 796, 984, 1091.
Smith, Thorn, 207, 313, 327, 340, 614.
Smith, W., 478.
Smith, W. G., 58, 261, 949.
Smolenski, P. O., 482.
Smyth, E. A., 120.
Smythe, A. T., 1000.
Snellen, P. C. T., 767.
Snow, C. H., 575.
Snyder, H., 418, 767, 812, 831, 843 872, 883, 1018, 1099, 1100.
Soave, M., 516, 1056.
Sobernheim, G , 193.
Sohut, F., 31.
Sokhotski, J. J., 98.
Soldner, 313.
Solla, 948.
Solonenko, M. P., 340.
Somerville, W., 300, 355, 458, 494 700, 842, 1027, 1072, 1076, 1077.
Sonn, S , 313.
Sonnenschmidt, 154.
Sorauer, P., 60, 362, 372, 910, 949.
Sorensen, C. W., 87.
Soresi, G., 80.
Soule, A. M., 100, 188, 280, 284, 298, 1076.
Southwick, J. M., 957.
Soutter, W., 220, 241, 315, 340.
Sovietov, A., 623.
Spalding, V. M., 746.
Spaulding, P., 1097.
Spear, V. I., 996.
Speir, J., 696.
Spencer, G. L , 482.
Spencer, L. S., 44, 1038.
Sperry, F. P., 353.
Speschnew, N. v., 1061.
Spica, M., 22.
Spillman, W. J., 415, 688, 984.
Splendore, A., 515.
Spoerer, B., 561.
Sprague, J. D., 594.
Spring, W., 129.
Stachelhausen, L., 291.
Stadler, E., 594.
Staes, G., 91, 173, 174, 175, 371, 477.
Stahl-Schröder, M., 35, 513.
Stalker, M., 199.
Stapf, O., 819.

Starnes, H. N., 147, 167, 178.
Staszi, P., 794.
Stearns, T. C., 1100.
Stebbins, J. H., jr., 679.
Stebler, F. G., 155, 1055.
Steddom, R. P., 996.
Stedman, J. M., 268, 367.
Steedman, A., 599.
Steel, T., 458.
Steele, E. S., 450.
Stein, V., 22, 23.
Steinitz, F., 813.
Stejneger, L., 428.
Stenström, O., 89, 796.
Stenström, O. E., 193, 695.
Stern, A. L., 715.
Stewart, F. C., 57, 257, 1058, 1061.
Stewart, H., 593.
Stewart, J., 441, 459, 788.
Stewart, J. D., 696.
Stewart, J. H., 34, 239, 774.
Stewart, S., 290.
St. Friis, 394.
Stientenroth, 495.
Stillman, T. B., 22.
Stinson, J. T., 600, 1000.
Stjernquist, O., 156, 750.
St. John, S. J., 199.
Stock, A., 1007.
Stock, F. K., 153.
Stockbridge, H. E., 334, 376.
Stockman, S., 393.
Stockman, W. B., 429.
Stokes, A. W., 676.
Stoklasa, J., 121, 163, 217, 321, 529, 818, 918, 948, 1016.
Stolle, F., 1007.
Stone, G. E., 25, 159, 551.
Stone, J. L., 237.
Stone, J. M., 899.
Stone, R., 396, 497.
Stone, W. E., 1097.
Storch, K., 904.
Stottlemyer, W. B. 937.
Stowasser, R., 67.
Strand, E., 66.
Stratton, R. W., 1085.
Straub, W., 483.
Strauss, I., 494
Strebel, 1036.
Strebel, M., 92, 593, 794
Street, J. P., 720, 777, 829.
Stringfellow, H M., 937, 1047.
Strohmer, F., 481, 576.
Strong, L. M., 200.
Stroyev, P. N., 52, 154.
Stuart, W., 342.
Stubbe, L., 996.
Stubbs, W. C., 28, 39, 67. 146, 230, 397.
Stupart, R. F., 430.
Sturgis, W. C., 715, 754, 755, 757.
Sturtevant, E. L., 23, 300.
Stutzer, A., 39, 110, 381, 443, 576, 715, 789.
Sulin, V. M., 895, 993.
Summers, W. L., 138, 340.
Susta, J., 484.
Susuki, U., 511.
Swain, S. H., 289.
Swalm, A. W., 997.
Swaving, A. J., 812, 826, 451.
Sweetser, W. S., 436.
Swiecicki, B. von, 321.
Swingle, W. T., 399, 548, 1047.
Switzler, I., 800.
Sylviac, 172.
Syme, W. A., 600.
Symons, G. J., 818.
Syniewski, W., 814.
Taber, G. L., 399.
Tacke, B., 506.
Taft, C. P., 547.
Taft, L. R., 50, 57, 64, 99, 153, 250, 252, 274, 275, 400, 931, 1047, 1059.
Tainturier, E., 80.
Tairov, 745.
Takabayashi, S., 710.
Taliaferro, W. T. L., 297.
Tancré, 44, 361, 1084.
Tanner, J. M., 899, 1098.
Tapken, A., 696.
Taranukhin, V. A., 893.
Tardent, H. A, 240.
Targioni-Tozzetti, A., 475.
Tartakovsky, M., 289.
Tassilly, E., 432.
Tate, R., 458.
Tavallazzi, T., 289.
Taylor, H., 290.
Taylor, O. M., 734
Taylor, R. L., 60.
Taylor, S. J., 688.
Taylor, W. A., 400.
Teddie, J., 1085.
Teeters, J. L., 499.
Teetz, 797.
Teisserenc de Bort, L., 517, 820.
Ten Eyck, A. M., 215, 226, 325, 331, 338.
Teodoresco, E. C., 119.
Tepper, J. G. O., 958.
Terracciano, A., 443.
Thatcher, R. W., 297.
Theobald, F. V., 392, 427, 495, 561, 712, 765, 766, 767, 870, 956.
Theoktistov, A., 122.
Theulier, H., jr., 250.
Thielé, E., 155.
Thiele, P., 443.
Thiele, R., 174, 950.
Thierry, A., 548.
Thiessen, A. H., 222.
Thiry, L., 1038.
Thiselton-Dyer, W., 1053.
Thomas, H., 199.
Thomassen, 290.
Thompson, C. B., 818.
Thompson, J. L., 734, 1039.
Thompson, W. G., 380.
Thoms, H., 482, 619.
Thomson, A., 460.
Thomson, G. S., 92, 188, 688, 790.
Thomson, H. M., 542.
Thorne, C. E., 228, 691, 926.
Thorne, R. T., 694.
Thorp, F. H., 212.
Thuma, A., 956.
Tidswell, F., 695.
Tiemann, 587, 789.
Tillinghast, J. A., 262, 641, 642, 908, 914, 915, 924, 944.
Timpe, H., 311.
Tinsley, J. D., 398.
Todaro, F., 56, 157, 750.
Todd, M. R., 200.
Tollens, B., 304, 705, 706, 910.
Tolman, C. F., 622.
Tolomei, G., 321, 355.
Tomarov, 893.
Tomasczevski, E., 694.
Toporkov, S., 28.
Torralbas, J. I., 790.
Tortelli, M., 23.
Toumey, J. W., 253, 458, 842, 850, 858.
Tourchot, A. L., 578.
Towar, J. D., 1037.
Tower, O. F., 213, 311.
Townsend, C. H. T., 298.
Townsend, C. O., 260, 1055.
Townsend, T. F., 127.
Trabut, 644, 657, 659, 917.
Tracy, S. M., 381, 1099.
Tracy, W. W., 1099.
Traphagen, F. W., 223, 305, 441, 537, 823.
Trasbot, 291.
Treiner, Y., 766.
Trelease, W., 1099.
Treupel, G., 185.
Trillat, A., 228
Troester, C., 394.
Troili-Petersson, G., 284.
Troncet, L. J., 80.
Troop, J., 657.
Trotter, A., 562.
Trouchot, C., 166.
True, A. C., 98, 397, 407, 408, 412, 498, 799.
True, G. H., 186.
Truelle, 294.
Truffaut, G., 649.
Trybom, F., 1066.
Tryon, H., 256, 372, 556, 658, 956.
Tschermak, E., 710.
Tsuneto, K., 723.
Tuck, W. H., 200.
Tucker, G. M., 506, 699, 910.
Turkin, E., 496, 593.
Turnbull, R., 515.
Turner, F., 220.
Turner, G., 88.
Tutt, J. W., 765, 1064.
Tyler, W. W., 395.
Tyurmoryezov, A. E., 894.
Ude, M., 766.
Ulbricht, R., 1023.
Ulrich, J. C., 1093.
Unwin, W. C., 942.
Urusov, S. P., 779.

Usoltzev, E. N., 594.
Vadam, 510.
Vaeth, J. G., 288.
Vallée, H., 292, 796.
Vanatter, P. O., 298.
Van Breda de Haan, J., 711.
Van Damme, C., 592.
Van Deman, H. E., 399.
Van den Berck, L., 732.
Vanderpoel, A., 184.
Van der Sluijs, D., 92, 694
Vandevelde, A. J. J., 121, 353.
Van de Velde, H., 693.
Van de Ven, A. J., 320.
Van Deventer, C. M., 811.
Van Dyke, T. S.. 294, 597.
Van Engelen, A., 284, 312, 489.
Vanha, J., 856.
Van Haarst, J., 748.
Van Haastert, J. A., 734.
Van Houten, G. H., 397.
Van Lynden, A. F., 56.
Van Melckebeke, E., 511.
Van Norman, H. E., 340, 667.
Vannuccini, V., 28, 59.
Van Rijn, J. J. L., 487.
Van Romburgh, P., 121.
Van Slyke, L. L., 238, 241, 917.
Van Zijverden, J., 495
Varlikh, V. K., 59.
Vawter, C. E., 299, 900, 1098.
Vernon, J. J., 899, 1000.
Verry, L. C., 577.
Verson, E., 370, 870.
Vert, G., 657.
Viala, P., 159.
Vibrans, 827.
Vietch, F. P., 297, 528.
Vieth, P., 284, 975.
Vigna, A., 60
Villèle, A. de, 434, 577, 644, 1022.
Villon, A. M., 618.
Vilmorin, H. L. de, 3, 201, 300, 547
Vincenheller, W. G., 199.
Vincent, 750.
Vines, S. H., 124.
Viola, P., 90, 905.
Viollet, P., 894.
Viquerat, 791.
Virchow, C., 672.
Vis, 184.
Vivian, A., 138, 578, 579, 580.
Vivien, A., 1056.
Vizmanos, L. S., 288.
Vöchting, H., 710.
Voelcker, J. A., 490, 773, 856, 971.
Voges, O., 290.
Voglino, P., 261, 759.
Voigt, 496.
Volker, H., 127.
Voorhees, E. B., 439, 444, 1099.
Voorhees, L. A., 208, 767, 768, 777, 829.
Voorhees, S. S., 937.
Vose, E. C., 620.
Votoček, 706.
Vries, H. de, 546, 1016.
Vries, J. J. O. de, 488.
Vrieze, K. de, 442.
Vrijburg, A., 591.
Vrooman, C., 199.
Vuillier, P., 79.
Vulte, H. T., 1100.
Vuyst, P. de, 788.
Vysotski, G. N., 434.
Wacker, J., 28.
Wagner, 294.
Wagner, G., 516.
Wagner, P., 242, 505.
Waite, M. B., 260, 447.
Walck, G., 1006, 1007.
Waldron, C. B., 264.
Waldron, L. R., 200.
Walker, E., 464, 600, 1064.
Walker, G. K., 576.
Walker, H. D., 191.
Walker, J. S. H., 1089
Waller, A. D., 118.
Walsh, G. E., 172.
Walters, J. D., 999.
Walther, R., 998.
Walton, T. U., 74, 673.
Walz, F. J., 126, 127, 620.
Wampe, G. de, 341.
Wappenhans, C. F. R., 127.
Warburton, C., 765.
Ward, A. H., 1055.
Ward, A. R., 282.
Ward, C. W., 154.
Ward, H. M., 714, 861.
Warington, R., 514.
Warnier, W. L. A., 744.
Warren, F. V., 200, 600.
Warsage, F., 419.
Waterhouse, C. H., 889.
Waters, H. J., 236, 898, 1025, 1094.
Watkins, J. L., 41.
Watrous, C. L., 398, 400.
Watson, G. C., 731.
Watson, T. F., 438, 699.
Watson, W., 937.
Watts, H. M., 620.
Watts, R. L., 100, 148, 298.
Waugh, F. A., 47, 121, 154, 315, 321, 343, 347, 351, 352, 354, 399, 453, 853.
Wauters, J., 811.
Wauters, P., 284, 312, 489, 788.
Webber, H. J., 399, 423.
Weber, 493.
Weber, C. A., 43.
Weber, H. A., 1023.
Webster, F. M., 62, 267, 272, 472, 476, 766, 871, 951, 952, 1099, 1100.
Webster, H., 424.
Wedin, H., 788
Weed, C. M., 109, 269, 712, 1100.
Weed, H. E., 371.
Weems, J. B., 208, 1099.
Wehmer, C., 260, 709.
Weibull, M., 39.
Weidenbaum, J., 22.
Weigmann, H., 787.
Weil, R., 286.
Weinstein, B., 112.
Weinzirl, J., 487.
Weiss, E., 714.
Weiss, J. E., 167, 556, 758.
Weiss, O., 818.
Weissbein, S., 818.
Weissenfeld, 688, 977.
Welborn, W. C., 397.
Weleminsky, F., 122, 286, 322, 387.
Wellington, C., 137.
Wells, J. S. C., 312.
Wells, S. M., 899.
Wende, E., 588.
Werenskiold, F. H., 79, 706, 789.
Werner, C., 516, 710.
Wery, E., 80.
West, M., 497.
Westgate, J. M., 200.
Weston, C., 499.
Weyl, T., 718.
Wheeler, C. F., 54, 58.
Wheeler, H. J., 311, 435, 438, 627, 641, 642, 824, 905, 908, 914, 915, 917, 918, 924, 1003, 1026.
Wheeler, W. P., 76, 80.
Wheler, E. G., 593, 891.
Whipple, G. C., 133, 813.
Whitaker, G. M., 588.
White, B. O., 307, 313, 328, 336, 381, 437.
White, H. L., 99.
Whitney, M., 133, 729.
Whitson, A. R., 299.
Whitten, J. C., 349, 899, 1090.
Wibbens, H., 381.
Wickson, E. J., 408, 412, 659, 1047.
Widtsoe, J. A.. 1098.
Wiechmann, F. G., 617.
Wieler, 710.
Wiener, M., 545.
Wiesner, J., 121, 128.
Wilcox, E. M., 117, 1098.
Wilcox, E. V., 266, 905.
Wild, L., 937.
Wilding, T., 983.
Wiley, H. W., 67, 204, 310, 311, 441, 509, 535, 536.
Wilhelmi, A., 797.
Wilkinson, F., 144.
Willach, P., 93.
Willard, J. T., 199, 236, 432, 699, 927.
Willcocks, W., 826.
Wille, N., 241.
Williams, C. B., 200, 206.
Williams, G., 398.
Williams, J. B., 207.
Williams, T. A., 23, 340, 423, 443, 539, 926.
Williams, W., 99.
Williamson, E. B., 428.
Willis, E., 723.
Wilms, J., 927.
Wilsdorf, G., 462.
Wilson, D., 888.
Wilson, G. W., 99.
Wilson, J., 940, 1100.

Wilson, J. E., 900.
Wilson, J. H., 152.
Wilson, J. M., 95, 597.
Wilson, L. L. W., 817.
Wilson, N. E., 138.
Wilson, T., 200.
Wilson, W. L., 699.
Wilson, W. M., 127.
Winberg, H., 734.
Winberg, H. L. O., 86.
Windisch, R., 510.
Wing, H. H., 81, 384, 389.
Wing, J. E , 295.
Winkler, L. W., 312.
Winner, W. W , 623.
Winogradsky, S , 424, 711.
Winston, G. T., 200.
Winter, H., 146.
Winterstein, E., 1056.
Wintgen, M., 672.
Winton, A. L., 297, 769, 777, 1100.
Wirthle, F., 587.
Wirtz, A. W. H., 195, 693
Withers, W. A , 200, 278, 408, 960, 970, 984.
Wittmack, L., 299.
Wohlmuth, J , 796.
Wohltman, F., 700
Wolckenhaar, 442.
Wölfer, T., 221.
Wolff, J., 214.
Wolff, M. J., 510.
Woll, F. W., 138, 148, 528, 585, 883, 1083.
Wollny, E., 44, 134, 526, 604, 648, 716, 805, 917.
Wood, E. M., 477.
Wood, M. B., 688.
Woodbridge, S. M., 395, 916.
Woodhead, S. A., 557.
Woodman, A. G., 218.
Woods, A. F., 52, 261, 454, 462, 466.
Woods, C D., 137, 279, 829, 917, 942, 959, 960, 970, 971.
Woodworth, C. W., 64, 407, 476, 1097, 1100.
Woolverton, L., 251, 547.
Wooster, E. W., 352.
Worsdell, W. C., 650, 745.
Wright, J. B., 995.
Wright, J. M., 285.
Wright, R. P., 242 332, 1028
Wulff, D , 1090
Wulff, T., 116.
Wurtz, G. B., 127.
Wyrouboff, G., 705.
Wythes, G., 51.
Yachovski, A. A., 362
Yasuda, A., 424, 910.
Yoe, W. T., 199.
Young, A. G., 587.
Young, J. M., 795, 1089.
Young, S., 511.
Youngers, P., jr., 849.
Zacharewicz, E., 745, 842.
Zadik, H., 483
Zahn, O., 704.
Zamaron, V., 213.
Zande, K. H. M. van der, 389.
Zavitz, C. A., 628, 632, 658.
Zecchini, M., 112, 138.
Zega, A., 111, 481, 813.
Zehntner, L., 66, 370, 476, 564.
Zenoni, C., 495.
Zersch, R., 649.
Zotsche, F., 312.
Zimmermann, A., 262, 275, 948, 959.
Zolotnitsky, N. F., 296.
Zschokke, E., 289.
Zuelzer, G., 510.
Zunst, N., 706, 777.
Zuntz, N., 72, 381, 482.
Zunz, E., 510.
Zurn, E. S., 174, 594.
Zurn, F. A., 588.

INDEX OF SUBJECTS.

Page.
Aberia caffra, notes 454
Abortion, epizootic, treatment 289
in cows, notes 696, 995
treatment 88, 192, 289, 495, 1088
N. J 791
sheep, causes and extent of occurrence, N. J 792
incubation period 696
types 92
Acacia cunninghami, notes 220
delibrata, notes 220
penninervis, notes 220
Acacias as forage plants 220
Acclimation fever. (*See* Texas fever.)
Acclimatization of plants 1015
Acetone, occurrence in plants 121
Acid fermentation, relation to butter flavor and aroma, Iowa 388
gases, effect on plants 710
phosphate. (*See* Superphosphate)
solutions, effect on phosphates in soil. 131
Acidimetry, notes 813
Aconitum in North America 709
Acorns, destruction by *Gastropacha quercus* 371
Acrididæ of New Zealand, notes 766
remedies 658
Acridium peregrinum, notes 1063
Acrolein as a germicide 998
Actinomyces, development 893
group and bacteria 494
morphology 393
Actinomyces farcinicus, notes 795
Actinomycosis, frequency of infection by various channels 1090
in Massachusetts, notes 1087
Spain, notes 288
inoculation experiments 1088
notes 91, 285, 995
Kans 498
transmission to man 288, 898
treatment 193, 995
Actinomycosis musculorum suis, notes 288
Æcidia on Umbelliferæ 167, 949
Aeration of the soil 526
Aerial observations, U. S. D. A 127, 621
roots, functions 710
Æthusa minor poisonous to cattle 796
After ripening of small grains 1054
Agalactia, contagious 1091
Agaricus melleus, notes 469
parasitism 516
mucidus, notes 516
velutipes, biology 28

Page.
Agaricus, renamed Psalliota 709
Agave sisalana, notes 443
Agelastica, estivation 656
Agglutinins, relation to lysins in anthrax 494
specific, in bacterial cultures 493
Agricultural—
and plant chemistry 617
Association of Portugal, proceedings. 296
bacteriological laboratory in Russia, report 393
climatology station at Juvisy 821
colleges and experiment stations in the United States, U. S. D. A 98
in the United States, types, U S. D. A. 498
mission 599
statistics for 1899 801
conditions in the Russian Baltic Provinces 296
cooperative societies in Belgium 442
department and experiment stations in Jamaica 808
for the West Indies 101
of Norway, report 799
Sweden, report 197
United States, relation to Weather Bureau, U. S. D. A 126
education, development 999
U. S. D. A 397
in Belgium 498
foreign countries 599
France 599
Ireland 599
rural schools 898
experiment stations. (*See* Experiment stations.)
implements, tests 97
Ind 335
Mich 96
imports and exports, U. S. D. A 296
Institute of Moscow, report 296
institutions in Egypt 1099
investigations in Alaska, U. S. D. A 42
literature of Poland 198
machinery in Denmark 294
materials, analysis methods, treatise 812
meteorology, notes, U. S. D. A 127
treatise 129
organization of Java and Ceylon 999
statistics of Great Britain 296
Students' Association, proceedings, Nebr 296
zoology, text-book 427

Page.
Agriculture and horticulture, school of applied 900
meteorology in the department of Hérault 599
as related to animal physiology 482
soil bacteria, Del. 435
in Alaska, U. S. D. A 98
Denmark 197
Finland, primitive 98
Hawaiian Islands, U. S. D. A. 497
Holland 898
Porto Rico, U. S. D. A 497, 536
Russia 98, 498, 799
Scotland 296
U. S. D. A 999
the South, U. S. D. A 397
instruction at Gembloux 498
methods of teaching, U. S. D. A 98, 799
report of Russian ministry 98
subarctic 1099
text book 599
university extension in 799, 1099
Agrilus anxius, notes 871
bilineatus, notes 764
sinuatus, notes 273
Agriotes obscurus, notes 765
Agromyza æneiventris, notes, U. S. D. A 952
phaseoli, attacking beans 561
n. sp., notes 563
Agrostis vulgaris. (*See* Redtop.)
Agrostology, systematic, recent additions, U. S. D. A 709
Agrotis biconica affecting indigo 1063
exclamationis, remedies 658
infusa, notes 766
messoria, notes, Md 62
saucia, new form 658
segetis affecting indigo 1063
segetum, notes 370, 765
remedies 658
Air currents in thunderstorms, U. S. D. A 620
dynamics, laboratory experiments, U. S. D. A 621
effect on butter 584
flow through rigid porous media 518
iodin content 133
liquid, as a source of power, U. S. D. A 222
methods of examining 482
movements 821
respired, apparatus for measuring 971
temperature at different heights 819
Airol as an antiseptic 797
Alabama Canebrake Station, financial statement 295
College Station, financial statement 697
notes 297, 499
Alaska, agricultural capabilities, studies, U. S. D. A 98
experiments, U. S. D. A 497
botanical survey, U. S. D. A 28
climate, U. S. D. A 31
stations, notes 499
report 43
Albumin, egg, sugar from 23

Page.
Albumin, egg, studies 309, 766
estimation by ammonium citrate 510
hybrid fecundation 1016
Albuminoid bodies of cows' milk 904
total, determination in peptic digestion 971
Albuminoids, determination 418
in urine, determination 23
recent work on 618
Albumoses, determination 311, 813
Alcohol analysis, manual 618
as a protector of protein 576, 672
effect on metabolism 184
muscular work 79
secretion of milk 973
food value 880, 971
U. S. D. A 770
for determining acidity of milk 1007
lactic acid 1006
in milk as affected by distillery malt 284
the vegetable kingdom 1015
manufacture from sugar beets 535
yeasts, genetic relation to molds 125
Alcoholic liquids, determination of fusel oil 313
Aldehyde in leaves 710
Aldehydes as affected by "Sorbose bacteria" 125
Alder, American, notes, Can 855
parasite, notes 467
Aleurodes lactea, notes 66
longicornis, notes 66
tabaci, notes, U. S. D. A 472
Aleurodidæ, notes 476
Alfalfa, analyses 842
Can 617, 662
La 231
Okla 277
Utah 663
as related to bees 266
culture 643
experiments, Colo 339
S. Dak 43
in Kansas 333, 927
digestibility, Can 662
Utah 663
effect on young orchard trees 1048
experiments with Nitragin, Mass. Hatch 516
fall preparation for seeding, Kans 498
feeding value 576
fertilizer experiments 643
for green manuring, Ariz 254, 833
pigs, Kans 377
sheep, Can 662
steers, Utah 663
growing under irrigation 240
hay, digestibility, Kans 381
for pigs, Kans 182, 498
U. S. D. A 397
nutritive value 78
prevention of mold, Kans 333
in eastern Kansas 926
Kansas, Kans 1037
insects affecting 563

Page.
Alfalfa, new species of Cuscuta attacking.. 1057
notes, N. Dak.
pasturage for pigs 1070
sheep, Colo 378
root rot, treatment, Ariz 253
seed of different regions, comparison 156
viability 157
time for cutting, U. S. D. A 599
Turkestan, notes 1037
varieties, Mich 43
Okla 1036
vs. red clover hay for lambs, Can 666
worm, remedies 1064
Algæ as affected by arsenic 1016
certain chemicals 910
effect on greenhouse plants 906
fixation of nitrogen 516
Alinit as a fertilizer 121
bacteria, nitrogen assimilation 1016
bacterium 1016
experiments 26, 711, 1016
in floriculture 424
studies 29, 917, 1016
Alkali, black, formation by saltbushes 1099
effect on forest vegetation 434
plants, U. S. D. A 397
seed germination, Utah 459
Wyo 1052
salts, physiological rôle in plants, U. S. D. A 1008
soils, analyses 823
for sugar beets, U. S. D. A 296
notes, U. S. D. A 133
of Montana 223
plants for, U. S. D. A 397, 423
Alkalimetry, indicators 310
Alkaline chlorids, surface tensions of solutions 112
Alkalis in water, determination 813
Alkaloids in urine, determination 23
rôle in plants 317
vegetable, constitution 619
Allescheria laricis, n sp 556, 1061
Allionia nyctaginea, notes, Nebr 315
Allorhina nitida, notes, U. S. D. A 952
Almond, double flowering, affected by *Monilia fructigena*, Conn. State 757
Alnus viridis, notes, Can 855
Aloes, fungus disease 469
Alpine gardens, plants for 52
plants, production by alternation of temperatures 421
Alternaria brassicæ affecting turnips, Mich. 58
nigrescens affecting muskmelons, Conn. State 755
Alternaria causing muskmelon disease, Mass. Hatch 552
Alum for purification of water 526
Alumina, determination 106, 613
Amanita muscaria, notes 121
pantherina, notes 121
phalloides, notes 121
verna, notes 121

Page.
Amblyomma hebræum, notes.
unipunctata, notes, La 588
unipunctata, notes, Va 173
American Cereal Co. poultry feed, analyses, Me.. 279
meal analyses, Me. 279
Ammonia, effect on incubation of eggs 1093
in fertilizers, determination 506
water, determination 112, 312
oxidation by soil ferments 212
Ammoniacal nitrogen vs. nitric nitrogen 831
Ammonium chlorid solutions, solvent effect on ammonium phosphate precipitate 107
citrate for estimating albumin 510
magnesium phosphate of analysis, constitution 107
phosphomolybdate, precipitation 419
salts, toxic effect 710
sulphate. (*See also* Sulphate of ammonia.)
containing free sulphuric acid 627
fertilizing value 438
Amœba meleagridis, notes, U. S. D. A 985
Ampelopsis, diseases, treatment, N. J 752
Amphicarpæa monoica, notes 817
Amphicerus bicaudatus, notes, U. S. D. A. 366, 952
Amphistomum hepaticum, notes 289
Amygdaleæ, hydrocyanic acid content 320
Anaerobic bacteria as causes of disease 194
studies 288
Analysis, methods. (*See* Feeding stuffs, fertilizers, foods, etc.)
Anarsia lineatella, notes, Oreg 466
Anasa armigera, notes, U. S. D. A 363
tristis, notes, U. S. D. A 363, 952
Anatomy of plants from standpoint of classification 121
Andromeda japonica, notes 271
Anæsthetics, effect on formation of chlorophyll 119
germination 1056
vegetable and animal protoplasm 118
vitality of dry or moist seeds 1056
Angleworms and warm rains, U. S. D. A 819
Angoumois grain moth, notes 955
Conn. State.. 762
Animal diseases, manual 591
heat, chemistry 482
matter for poultry, U. S. D. A 397
meal for pigs 483
vs. cut fresh bone for chickens, Mass. Hatch 573
organism as affected by blood serum of other animals 892
physiology as related to agriculture 482
handbook 184
products, imports and exports, U. S. D. A.
vs. vegetable food for poultry, N. Y. State 76

Page.

- Animals, acclimatization 296
  - as affected by bacillus of black
    - plague of man.. 91
    - smut spores...... 91
  - calculation of rations 184
  - domestic, insect pests 263
  - narcosis 291
  - noxious, danger of introducing, U. S. D. A 425
  - sanitary regulations 592
- *Anisoplia agricola*, affecting cereals........ 1057
  - *austriaca*, remedies 658
- *Anopheles bifurcatus*, notes.................. 957
  - *claviger*, notes 957
  - *pseudopictus*, notes 957
  - *superpictus*, notes................. 957
- *Anthonomus pomorum*, affecting fruits..... 1057
  - notes.............. 870
  - *signatus*, notes, U. S. D. A...... 952
- Anthrax as affected by creolin 894
  - bacilli, production of toxin 795
  - bacillus, agglutination by human blood 393
    - as affected by lecithin .. 893
    - differential diagnosis, U. S. D A...... 985
    - effect on immunized sheep 890
    - interaction with specific antitoxin 890
    - plasmolysis............. 893
    - reaction in a colored nutrient medium........... 794
    - studies 286
  - biology and method of contagion 893
  - cultures, virulence as affected by different conditions........ ... 893
  - diagnosis 894
  - effect on bile.......... 695
  - emphysematous 1091
  - growth on various culture media.. 893
  - immunity of lymphatic glands .. 995
  - in New South Wales 695
    - New York 492
    - Norway 693
    - soil, destroying 894
    - West Gothland 393, 695
  - infested animal hair, disinfection. 695
  - like bacillus, Del...... 493
  - nature and remedies 393
  - notes 91, 92, 288, 995
    - U. S. D A 995
  - preventive inoculation 793
  - relation of agglutinins to lysins 494
  - symptomatic, in Massachusetts 1087
  - transmission by insects... 995
    - to man...... 393
  - serum tests 795
  - vaccination 190
- *Anthrenus verbasci*, natural enemy of the gypsy moth 560
- Antianthrax substances, behavior in dogs and rabbits 1091
- Antifebrin for acute laminitis.............. 394
- Antiherbium, tests......................... 1057
- Antiopa butterfly, remedies, N. H.......... 160

Page.

- Antiplague serum, technique of inoculation for 1069
- Antiseptic power of iodoform............... 496
- Antiseptics, effect on wine micro-organisms. 198
  - for milk, Wis 599
- "Antispire" system, analyses of bread made
  - by 481
  - of bread making...... 478
- Antitetanus serum 286
- Antitoxin, presence in normal horses 794
- Antitoxins, effect in digestive canal....... 194
- Antityphic substances, origin.............. 689
- Ants, effect of leucocytes in metamorphosis. 870
  - notes 955
  - of Madagascar, notes 870
  - remedies, N C 342
  - white, on carnations, remedies 1065
- Apatite, analyses 230
- Aphididæ, notes........................... 476
- *Aphis brassicæ*. (*See* Cabbage-plant louse.)
  - *fabæ*, notes 370
  - *forbesi*, notes, U. S. D. A 952
  - *gossypii*, notes, Ga 864
    - U. S. D. A 952
  - *phaseoli*, notes......................... 370
  - *prunicola*, notes, U. S. D. A 952
  - *ulmaræ*, notes 563
- Aphthous fever in Turkey 593
  - prevention 92
  - serum theraphy........... 593
  - treatment 493
- Apiary, experiments in 1099
- Apiculture, manual 369
  - studies 172
- *Apiosporum brasiliense*, n. sp , notes ... 59, 260
- *Apocynum sibericum* as a textile plant 538
  - *venetum* as a textile plant...... 538
- Apoidea, classification 271
- Apoplexy, parturient, treatment 192
- Apparatus, for detecting trichinæ 290
  - distilling water 313
  - hypodermic injection....... 896
  - incinerating plants.... . 304, 506
  - pasteurizing and sterilizing, N. J 714
  - plant study 28
  - preventing backward flow of water................... 619
  - registering growth of plants 911
  - regulating and measuring work performed by man.. 777
  - seed examination 156, 750
  - high pressure 313
  - new filtering 313
    - form of potash bulb....... 313
  - pinchcock....................... 313
  - polarization..................... 214
  - reflux condenser 814
  - river gauge, U. S. D. A 818
  - spraying, Me..................... 262
    - N. Y. State............ 172
    - R. I 262
    - U. S. D. A............ 259
  - thermometer holder 288
  - weighing tube 112

Page.
Apple aphis, green, notes, Can 863
remedies, Ala. College 1042
notes, Ky 170
woolly, notes 1057
Apple bitter rot, notes 260
black rot, notes 260
blight, bacterial 260
notes, Colo 314
borer, notes 66
brown spot, notes, N. H 255
bud moth, fringed-wing, notes, Kans 498
curculio, notes 272
fly speck, notes 260
fruit miner, notes, Can 863
jelly, analyses 882
leaf blight, notes, Mont 1048
blister moth, remedies 956
crumpler, notes 272
Ky 170
folder, lesser, notes 272
rust, notes 260
Ky 170
treatment, Ala. College 1042
skeletonizer, notes, Ky 170
mildew, notes 260
Monilia 949
nursery stock as affected by freeze of 1899, Wis 930
peelings and leaves as affected by iron sulphate, Mo 1043
powdery mildew, notes 260
scab, notes 260, 556
Ky 170
Mass. Hatch 561
N H 255
spraying experiments, Ill 258
treatment 758
Can 651
Del 468
Idaho 1059
Vt 356
scald, notes, Vt 356
soft rot, notes 260
spot, notes 260
tree, affected by longicorn beetle 1063
borer, flat-headed, affecting plum trees, Wash 1064
borer, flat-headed, notes, Mo 268
round-headed, notes 955
Mo 268
canker, notes 260
treatment 758
fire blight, notes 758
tent caterpillar—
natural enemies, N. Y. State 170
notes 173, 955
Ky 170
N. Y. Cornell 368
weevil, bronze, notes, Can 863
trees, bud development 851
vs. piece-root grafting, S. Dak 848
close root pruning 1047
influence of stock on top 51
root killing, S. Dak 848
pruning 152, 548
Apple trees, root pruning, Del 845
R. I 928
spraying experiments 167
whole vs. root grafting 548
young, as affected by alfalfa 1048
twig blight, notes 260
borer, eye-spotted, U. S. D. A 866
twigs and leaves, analyses, Mo 1042
Wealthy, notes 154
worm. (*See* Codling moth.)
Apples, analyses 51
and pumpkins for pigs, N. H 967
as affected by unusual cold, Ala. College 1041
ash analyses 157, 229
Ben Davis 154
evaporation 851
fertilizer requirements 45
fruit development as affected by seed development 926
grafting on honey locusts 850
peaches 850
hardy stocks for, S. Dak 848
iron content 157
notes, S. C 1047
parasitic diseases 949
pollination experiments, U. S. D. A 447
Russian, tests, Iowa 647
storing with vs. without wrapping 849
varieties 157, 251, 937
Can 547, 844, 850
Mass. Hatch 544
Mich 153, 252
Mont 251, 1048
N. H 152
Okla 929, 1036
winter keeping qualities 849
Apricot trees, abnormal growths 556
Apricots, bud development 851
fruit development as affected by seed development 936
irrigation in winter, Ariz 847
varieties, Mont 251
Okla 929, 1036
Aquilegias in North America 709
Arabic acid from sugar beets 706
Arachidic acid, notes 23
Arachnids as carriers of disease 995
new species 265
Aræocerus fasciculatus affecting coffee 1065
Arctic regions, photochemical climate 128
Areca affected by spotted locusts 477
Argas americanus, notes 291
Argentum Credé as a diagnostic in glanders 1092
Arginin, protein compounds 511
Argyresthia conjugella, notes 765
Can 863
Argyresthia notes 66
Arid lands, cession for irrigation 195
legislation for reclamation 195
region, obstacles to settlement 195
reservoirs 294
vernal phenomena 421
soils, physical and chemical peculiarities 717
Arizona Station, financial statement 897

Page.
Arkansas Station, financial statement 295
notes 199, 600
University, notes 600
Armillaria tumescens, notes 121
Army ration in the Tropics 882
worm, black, notes, Can 862
notes 870, 955
remedies, Ohio 63
Aromatic principles, development by alcoholic fermentation 125
Arrowroot, culture 442
notes 240
Arundo donax, notes, U. S. D. A 423
Arsenate of lead and Paris green for tortoise beetles, Md 62
as an insecticide 66
improvement in manufacture, U. S. D. A 954
preparation and use, Mass. Hatch 174
Arsenic, determination in Paris green 313, 614
effect on plants 1016
for locusts 366
in superphosphates 331
test for 652
Arsenical poisoning as affected by leucocytes 91
poisons as insecticides 66
Arsenites. (*See* London purple and Paris green).
Artesian irrigation in Australia 1094
wells in New South Wales 395
Arthritis, chronic, of the stifle joint 191
Artichokes, globe, culture, U. S D A 1047
Jerusalem, for pigs, U. S D A 296
notes 649
Artotrogus debaryanus, notes, Conn. State 757
Asbestos for packing fruits 549
retention of moisture 906
Asclepias curassavica for repelling fleas 263
poisonous to stock 1057
Ash bark beetle, remedies 477
cost of planting, Can 854
culture 942
determination, apparatus 304, 506, 511
green, as wind breaks 550
of feces, analysis, Mo 1004
plants, preparation for analysis 506
white, as wind breaks 550
Ashes, analyses, Conn. State 719
Ky 314
Mass Hatch 527, 528
Minn 831
Asio acciptrinus, notes 428
wilsonianus, notes 428
Asparagin, nutritive value 275
Asparagus, analyses, Mass Hatch 1026
beetle, notes 66
remedies, N. J 762
12 spotted, remedies, N. J 762
culture 351, 547, 937
S. C 153
experiments, N. J 735
in the South 1047
fertilizer experiments 140, 1039

Page.
Asparagus, fertilizer experiments, N. J 735
fertilizers 351
forcing 450
irrigation 1039
experiments N. J 735
notes, S. C 1047
rust, notes, Mass. Hatch 159
Nebr 314
N. J 753
S. C 160
Vt 856
Aspergillus flavus, development as affected by deleterious agents 910
notes 67
glaucus, notes 67
minimus, n. sp., notes 709
niger, conidia formation in 424, 710
ostianus, n sp., notes 709
varians, n. sp., notes 709
Aspidiotus affecting citrus fruits 657
Aspidiotus ancylus, larvæ 657
notes 274
Ind 657
Iowa 958
on American fruit 655
remedies 958
camelliæ, larvæ 657
on American fruit 655
conchæformis, notes 64
fernaldi, notes 274
ficus, notes, Iowa 958
remedies 372
forbesi, notes 272, 274
Iowa 958
on American fruit 655
hederæ, notes, Iowa 958
juglans-regiæ, remedies 958
osborni, notes, Iowa 958
ostreæformis, larvæ 657
notes 274, 657, 870, 958
U S. D. A 953
perniciosus (*See* San José scale.)
rapax, notes, Iowa 958
scutiformis, notes 870
spurcatus, notes 274
uvæ, notes 274
zonatus, notes 274
Aspidisca splendoriferella, notes, Mich 954
Asses' milk, properties 973
Asses, tuberculosis in 393
Association of—
Agricultural Experiment Stations in Germany 505
American Agricultural Colleges and Experiment Stations 397, 405
Economic Entomologists 1100
Official Agricultural Chemists 204, 310, 1007
Official Agricultural Chemists, methods of analysis adopted, U. S. D A 509
Swiss Analytical Chemists, bibliography for laboratories 1007
Asteroma affecting Hemerocallis 261
Asters affected with Fusarium 261
Asthenia in fowls, treatment, U. S. D. A 994
Astycus lateralis affecting tea 1062
Asylum farm of Boise de Cerv 198

Page.
Atavism in the potato ... 710
Athalia spinarum, notes ... 765
Atlas meal, description ... 971
Atmosphere and the ether, U. S. D. A. ... 620
  average temperature, U.S.D.A. ... 621
  carbon dioxid of, as related to that of the ocean ... 622
  diurnal variation in electricity ... 432
  temperature variations ... 517
  terrestrial ... 432
  weight or mass, U. S. D. A. ... 222
Atmospheric dust, U. S. D. A. ... 222
  moisture and artificial heating, U. S. D. A ... 127
  phenomena, photography ... 819
  pressure, notes ... 819
Atriplex, description of species, Cal ... 636
Atriplex campanulata, analyses, Cal ... 637
  halimoides, in New Zealand ... 842
  leptocarpa, in New Zealand ... 842
  nummularia, analyses, Cal. ... 637
    in New Zealand ... 842
  semibaccata, introduction into California ... 636
    notes, U. S. D. A ... 1034
Attelabus curculionides, notes ... 706
Aulacaspis bromeliæ, notes ... 1065
Aureobasidium vitis album, new variety ... 261
Auroras in Texas, U S. D A ... 819
Avena micrantha, n sp., notes ... 1015
  stipoides, n. sp., notes ... 1015
Avocado, etymology ... 250
Ayrshire cattle, notes ... 983
  U. S. D. A. ... 983
  cow, management ... 788
Azalea indica, new disease ... 261
  pontica, notes ... 271
Azaleas affected by *Septoria azaleæ* ... 759
Azoturia, treatment ... 192
Bachelor's button, notes ... 858
Bacilli causing butyric fermentation in milk ... 688
Bacillus alvei, notes ... 291
  amylovorus, notes ... 260, 758
  anthracis, notes ... 492
    similis, notes ... 194
    n. sp., notes, Del. ... 493
  elegans, n. sp., notes ... 861
  ellenbachensis, studies ... 917, 1016
  enteritidis as affected by salt solutions ... 594
  gallicus, n. sp ... 714
  lactis viscosus, notes, N. Y. Cornell. ... 282
  lycopersici, notes ... 861
  mallei, classification ... 895
  megatherium, studies ... 1016
  mesentericus vulgatus as cause of sticky and slimy bread, Wis ... 565
  morbificans bovis as affected by salt solutions ... 594
  phaseoli, causing blight of Lima beans, Conn. State ... 757
  proteus vulgaris as affected by salt solutions ... 594
  solanacearum, notes ... 465
  subtilis, studies ... 1016
Bacillus tracheiphilus causing bacterial wilt of melons, Conn. State ... 754
    notes ... 465
  typhi abdominalis in milk and butter ... 786
  typhosus, notes ... 427
Bacillus, arrangement of species ... 424
  icteroid ... 192
  of anthrax, studies ... 286
    Eberth and coli bacillus, differentiation ... 892
    necrosis, notes ... 291
    Nocard-Preisz ... 696
    rats ... 393
Backhousia citriodora, notes ... 1052
Bacon, curing, N. C ... 497
  effect of feeding and exercise on, Can ... 670
Bacteria, agglutination and immobilization as related to growth ... 90
  anaerobic as causes of disease ... 194
    studies ... 288
  and barnyard manure ... 331
  as affected by salt ... 594
    applied to farm problems ... 125
    ferments, N. J ... 125, 714
  colonies in tube cultures, N. J ... 714
  decomposing cement ... 715
  effect on culture media ... 715
  growth as affected by formalin. ... 469
  immunity of lactic glands to ... 995
  in agriculture ... 125, 714
    barnyard manure ... 39
    cheese, distribution ... 487
    dairy products ... 688
    flowers ... 713
    roots of *Phaseolus multiflorus* ... 1061
    soils, studies ... 1099
    street dust, as affected by sprinkling ... 287
  lactic acid, in ensiled beet pulp ... 714
  of mice as affected by certain saprophytes ... 393
    soil, studies ... 218, 827, 917
    soils as related to agriculture, Del ... 435
    tubercles of legumes ... 218
    vinegar ... 715
    wine disorders ... 652
  phylogeny and polymorphism ... 125
  physiological activity as affected by conditions of growth in cheese ... 389
  preparation of culture media ... 122
Bactericide action as affected by overimmunization ... 292
Bacteriological Station of Kazan, report ... 195
  Kharkov, report ... 194
Bacteriology and dairying ... 688
  in agriculture and sanitation ... 714
    cheese making in Europe ... 285, 889
    European dairying, Conn. Storrs ... 886
    manual of principles ... 125

Page.
Bacteriolytic enzyms and immunity 194
Bacterium asthenicæ, n. sp., notes, U. S. D. A. 994
coli commune as affected by salt solutions 594
coli commune, producing omphalitis in calves 797
lactis acidi, notes 284
longi, notes 284
megatherium, notes 715
pabuli acidi, n. spp 714
sanguinarium, notes, U. S. D. A. 985
septicæmiæ hæmorrhagicæ producing omphalitis in calves .. 797
Bag moths, Australian, notes 658
Baguios of the Philippines, U. S. D. A 819
Bagworm, notes 66
Ky 170
Baking powder, adulteration, N. C 278, 971
analyses, Idaho 314
Balbiania, notes 894
Balloon ascensions in France, U S. D. A . 430, 621
Balsams, analysis methods, handbook 1008
Baltet pruning tables 852
Baltimore oriole, notes 428
Bamboo culture in southern Africa 549
shoots, growth 910
Bamboos, notes, U. S. D. A 423
Banana flour, analyses 79, 154
notes 575
culture 451
Bananas, fertilizers for 744
notes 154
Bands, tarred paper 175
Bárcena, Mariano, death, U. S. D. A 429
successor to, U. S. D. A .. 620
Barium, occurrence in plants and soils 619
Bark beetle destroyer, European, introduction into America, W Va 475
fruit tree, notes 272
Kans 498
Mo 268
U. S. D. A 366
remedies 264
Bark borer, flat-headed, notes 764
Bark louse affecting *Myrciaria cauliflora*, remedies 476
oyster-shell, notes 66, 1057
Conn. State 762
Ind 657
Ky 170
remedies 958
N. J .. 958
scurfy, notes, Conn. State 762
Ind 657
Ky 170
miners, notes 763
Barley, after ripening and germination 1054
analyses 643
and corn vs. molasses feed for pigs 69
oats vs. corn for cows 780
pea fodder, analyses, Conn. Storrs 882
digestibility, Conn. Storrs .. 874
peas, analyses, N J 777
as an adulterant of flour 482

Page.
Barley, black stem rust, U. S. D. A 643
breeding 144
broadcasting vs. drilling, Can 628
California, culture experiments, Colo 339
classification of varieties 44
crop of Hungary, 1899, U. S. D. A 698
culture, Can 642
Ga 841
effect of temperature on germination 156
fertilizer experiments. 39, 531, 539, 643, 842
Can 833
fodder, analyses, Conn. Storrs 882
digestibility, Conn. Storrs .. 874
germination tests, Can 857
limit of tolerance of sodium perchlorate 917
loose smut, Nebr 314
meal vs. corn meal for pigs 72
production for brewing 240, 539, 643
rotation experiments 842
seed selection, Can 630
temperature for germination 1056
varieties 842
Ariz 834
Can 628
N. Dak 332
viability 158
vs. corn for pigs, Minn 177
oats for horses 80
wheat for pigs 69
water absorption of seed 1056
weight of grain as related to nitrogen content 633
winter culture experiments 442
Groninger 539
yellow rust 259
Barn for cattle feeding 295
with framework of steel 294
Barnyard manure—
analyses, Tex 438
and bacteria 331
ash analyses, Okla 277
bacteria content 89
changes and treatment 229
for beets 725
handling, Mass. Hatch 137
loss of nitrogen 828
notes, U. S. D. A 397
pits, construction 830
preservation 331, 828
Can 827
relative value of nitrogen 435
spraying with sulphuric acid 726
treatment with acid superphosphates 135
utilization 1025
vs. cotton seed products, S. C 233
street sweepings 625
without preservatives, availability 134
Barographs on ships, U. S. D. A 222
Barometer, camphor, U. S. D. A 430
diurnal variation, U. S. D. A 620
history, U. S. D. A 819
Barometric corrections and reductions, U. S. D A 819
Barometry, plateau, U. S. D. A 621

Page.

- Barrenness in sheep, extent of occurrence, N. J 792
- Basic slag for grass, Del 141
- Bat guano, analyses, Conn. State 719
  - Tex 438
- Baum's horse and stock food, analyses, Conn. State 279
- Baumé's hydrometer 22
- Beach grass, notes, U. S. D A 423
- Bean anthracnose, studies 254
  - beetle, notes 562
  - fodder crops, Can 682
  - ladybird, natural enemies 470
  - leaf beetle, remedies, U. S. D A 471
  - pod spot, treatment, N. J 751
  - pods, blackening 511
  - vanilla, in Mexico 158
  - weevil, notes, Can 863
    - U. S. D. A 470
    - remedies, N. H 169
- Beans, analyses, N. J 737
  - and clover, assimilation of nitrogen 121
  - as affected by anæsthetics 1056
  - an adulterant of flour 482
  - bacterial disease 948
  - bacteriosis, treatment, N. J 751
  - Bonavis, analyses 249
  - bush, field experiments 1099
    - varieties, Mich 250
  - double cropping with sweet corn, N J 737
  - extent of variation within the variety, N. J 737
  - fertilizer experiments, N. J 737
  - field, nutritive value 73
  - inoculation experiments, Can 816
  - Mandura, analyses 249
  - notes, S C 1047
  - pole, forcing, N. H 147
    - U. S D. A 599
    - varieties, Mich 250
  - shading, N. J 739
  - spraying experiments, N. J 751
  - string, culture 250
    - notes, Ariz 850
  - temperature for germination 1056
  - thickness of sowing, N. J 737
  - varieties, Can 629, 632
    - N J 737
    - S. Dak 51
  - water absorption of seed 1056
- Beck's serum for swine diseases 290
- Beech roots, sclerotid disease 1061
- Beeches as affected by thinning 940
  - ornamental varieties 928
- Beef carcasses, determination of age 279
  - cracklings, ground, for poultry, Me 279
  - herd, cost of wintering, Miss 1084
  - prepared in different ways, nutritive value 672
  - scraps, analyses, Me 279
- Beehives, description 172
  - Mich 60
  - ventilated 172
- Beers, examination 970
- Bees affecting grapes, Mich 60
- Bees, anatomical studies 765
  - arrangement of frames and hives 870
  - as affected by temperature 271
  - breeding experiments, Mich 62
    - for longer tongues, Mich 1062
  - Carniolan, Can 652
  - classification 271
  - comb foundation experiments, Can 864
    - Mich. 62, 1062
  - dead brood, notes 271
  - determination of sex 561
  - experiments in keeping, Vt 370
  - experiments in wintering, Can 652, 863
  - feeding experiments, Mich 61
  - five-banded Italian 653
  - foul brood, notes 266, 370, 870
    - treatment, Mich 61
  - hearing 172
  - in relation to color of flowers 271
  - Italian 271
  - management 172, 271
  - marsh flowers for, Mich 1062
  - moving to fall pasture, Can 652
  - paralysis 271
    - Mich 61
  - parthenogenetic origin of drones 956
  - prevention of swarming 172, 561, 657
  - rearing and management 266
  - relation to alfalfa 266
  - relationship of members of colony 271
  - relative frequency of visits to various fruit blossoms 956
  - removal of queens during honey flow, Vt 370
  - securing wild swarms from trees 657
  - swarm catcher, description, Can 652
  - temperature for wintering, Mich 1062
  - tests of the plain section, Mich 1062
  - varieties 266
  - wax moth 266
  - winter cellar 172
  - wintering in cellars at high temperature, Mich 61
- Beet leaf spot, cause 468
    - treatment, N. J 752
  - puller and topper, tests 540
  - root worm, notes 429
  - seed, culture 45
    - germination apparatus 56
    - improvement 144
    - parasites, effect on sugar beets 948
    - treatment with carbon bisulphid, Mich 955
    - viability 158
  - "sickness," treatment 262
  - sugar industry as related to stock feeding and dairying 535
    - in Germany 443
    - residue as cattle feed, U S. D. A 482
    - process of manufacture 535
- Beetles affecting tea 1062
  - of middle Europe, monograph 562
- Beets affected by *Peronospora schachtii* 759
  - artificial species 232

Page.

- Beets, breeding ... 232
  - chemical changes produced by freezing ... 576
  - culture ... 241
  - fertilizer experiments ... 725
    - Mass. Hatch ... 543
    - N. J ... 444
  - fodder, transplanting ... 1037
  - for sheep ... 576
  - limit of tolerance of sodium perchlorate ... 917
  - notes, Ariz ... 850
    - S. C ... 1047
  - premature seed production ... 232
  - red, fermentation ... 715
  - stock, notes, S. C ... 1047
  - sugar. (*See* Sugar beets.)
  - varieties, S. Dak ... 51
  - water absorption of seed ... 1056
- Beggar weed, Florida, notes, U. S. D. A ... 339
- Begonias, breeding ... 453
- *Belippa lohor* affecting tea ... 1062
- Ben Nevis Observatory, U. S. D. A ... 819
- Bent grass seed, creeping, viability ... 158
- Benzoic acid in milk, detection ... 705
- Benzolin for phylloxera ... 175
- Bermuda grass, notes, Ala. College ... 154
  - smuts ... 949
  - lilies, causes of imperfect flowers ... 454
  - onions, culture ... 153
- Berries, edible, of Alaska ... 851
- *Beta maritima*, notes ... 232
  - *vulgaris*, notes ... 232
- *Betula alba laciniata*, notes, Can ... 855
  - *pumila*, notes, Can ... 855
- Beverages, analyses ... 314
  - methods of examining ... 482
- *Bibio hortulanus* affecting cereals ... 1057
- Bibliographical sketch of H. L. de Vilmorin ... 201
- Bibliography of dermatology ... 392
  - literature of Russian soils ... 32
  - meteorology, U. S. D. A ... 221
  - tuberculosis, 1899 ... 193
  - veterinary medicine ... 195
- Bile of anthrax-infected animals ... 695
  - diseased animals, effect on healthy animals ... 892
- *Bilharzia crassa*, study ... 696
- Billow clouds, wave, U. S. D. A ... 222
- Bindweed, eradication, Wis ... 749
  - notes, Can ... 651
    - Okla ... 354
- Biological survey of Mount Shasta, U. S. D. A ... 428
- Biology of *Agaricus velutipes* ... 28
  - closure of stomata ... 115
  - parasitic fungi ... 322
  - pollen ... 319
  - winter wheat ... 28
  - wood-frequenting fungi ... 322
- *Biota orientalis*, notes ... 949
- Birch, cut-leaved, notes, Can ... 855
  - dwarf, notes, Can ... 855
  - seed, management ... 355
- Bird flea, notes ... 263
  - lice of poultry ... 495
- Birds as weed destroyers, U. S. D. A ... 428
  - feeding habits ... 428
  - injection of sugar solutions ... 428
  - injurious, remedies ... 372, 659
  - migration, U. S. D. A ... 222
  - noxious, danger of introducing, U. S. D. A ... 425
  - of prey of Manitoba ... 425
- Black death, inoculation experiments ... 91
  - knot, notes ... 369
    - Ky ... 170
- Blackberries, analyses ... 1046
  - bud development ... 851
  - culture experiments, N. J ... 735
  - fertilizer experiments ... 1039
    - N. J ... 735
  - irrigation ... 1039
    - experiments, N. J ... 735
  - notes, Mont ... 251
  - varieties ... 650
    - Can ... 644, 850
    - Mass. Hatch ... 544
    - Mich ... 153, 252
    - Okla ... 929
    - Pa ... 452
    - Wis ... 150
- Blackberry leaf spot, notes, Colo ... 314
  - orange rust, notes, Colo ... 314
- Blackleg bacillus, notes, U. S. D. A ... 992
  - differential diagnosis, U. S. D. A ... 985
  - in Norway ... 693
    - the United States, U. S. D. A ... 991
  - notes ... 995, 1087
    - Kans ... 498
    - Nebr ... 393
    - U. S. D. A ... 995
  - transmission to man ... 288
  - treatment ... 793, 796
  - vaccination in Freiburg ... 593
    - precautions ... 695
    - technique ... 494
  - vaccine, preparation ... 288
    - Utah ... 1091
    - Va ... 494
  - studies ... 192, 593
- Black plague bacillus, effect on organs of animals ... 91
- Blast furnace dust as a fertilizer ... 1026
- Blastophaga experiments in California ... 1100
- *Blastophaga grossorum*, notes, U. S. D. A ... 950
- Blatchford's calf meal, analyses ... 971
  - Conn. State ... 279, 777
  - Me ... 279
  - N. J ... 777
- *Blatta germanica*, digestive organs ... 767
- Blister fluid, treatment ... 496
- "Blizzard," origin of word, U. S. D. A ... 221
- Blood corpuscles, agglutinization ... 292
  - determination of glucose ... 22
  - dried. (*See* Dried blood.)
  - molasses feed for horses ... 880
    - vs. grain for pigs ... 69
  - serum, effect on healthy animals ... 892
  - vessels, text-book of diseases ... 1090
- Blueberries, notes, Me ... 931

Page.
Bluebottle fly, notes 268
Blue grass, Kentucky. (*See* Kentucky blue grass.)
sand, notes, U. S. D. A 423
seaside, notes, U. S. D. A 423
seed, viability 158
joint grass, culture experiments, S. Dak 43
rays, effect on persistence of oak leaves 907
Bœhmeria nivea, notes 220
Bog land, reclamation 226
Boiling point apparatus 313
curves of certain mixtures .. 619
Boletus luridus, notes 121, 515
satanus, notes 121
Boll weevil, notes 273
Bollworm, host plants 871
notes 760, 955
U. S. D. A 471, 952
remedies 559
Ohio 63
U. S. D. A 471
Bonavis beans, analyses 249
Bone, analyses, Mass. Hatch 528, 1026
and meat, analyses, Mass. Hatch ... 138
potash, analyses, Conn. State 719
as an egg producer, Can 881
ash analyses, Mass. Hatch 138
availability for grass, Conn. State 722
dissolved, analyses, Ky 314
La 39
Mass. Hatch .. 1026
R. I 917
Tex 438
ground, analyses, Mass. Hatch 138
N. J 830
for calves 80
manures, analyses, Conn. State 719
superphosphate, detection of adulteration 104
vs. animal meal for chickens, Mass. Hatch 573
Boneblack, analyses, La 39
dissolved, analyses, Conn. State . 719
Mass. Hatch 1026
spent, analyses, Mass. Hatch ... 1026
Bont tick, notes 763
Boophilus bovis, notes, La 588
Va 173
remedies, U. S. D. A 491
Boracic acid, effects on animal body 962
in butter, determination 510
Borax, excretion by rabbits 778
separation from boric acid in preserved meat 618
Bordeaux mixture—
and arsenate of lead for sweet-potato flea-beetle, Md 62
Paris green for apple scab, Vt 356
Paris green for apple scab and codling moth, Ill 258
salt for grape black rot 262
effect on fruit development 262
for apple scab, Del 468
beet-leaf spot, N. Y. Cornell 163
chrysanthemum rust, N. J 947
Bordeaux mixture—Continued. Page.
for cucumber downy mildew, Ohio 357
grape black rot 758
peach-leaf curl 260
N. Y. Cornell 164
Ohio 357
plum lichens 321
potato blight, Vt 355
diseases 168
walnut bacteriosis 261
in hot climates 166
injury to pears 950
manufacture 556
preparation and use 371, 861, 950, 957, 1061
Conn. State 757
Mass. Hatch 174
Me 262
Borers, remedies, Okla 1066
Boric acid as a milk preservative 582
determination 112, 618, 1007
in milk, detection 212, 419
Jorgensen method of determining 618
tests 312
Borna horse disease, cause 588
Boron food preservatives 184
Botanic garden as an aid to agriculture.... 1099
Botanical institutions of Java and Ceylon. 999
survey in Alaska, U. S. D. A 28
Botany, text-book 1014
text-books, U. S. D. A 429
Botflies, notes 263
Botfly larvæ, distinguishing from glanders 896
Botrytis cinerea as a hothouse pest 360
sp., causing drop of lettuce, Mass. Hatch 552
treatment 552
vulgaris, notes 164
Bots in head of sheep 191
Bouillon cultures of bacteria as affected by metals 123
Bovine distemper, notes, Va 1091
malaria in Turkey 593
Bowker's animal meal, analyses, Me 279
pure beef scraps, analyses, Me.. 279
Box elder, analyses, Idaho 314
cost of planting, Can 853
grafting on honey locusts 850
peaches and walnuts 850
Box, yellow, notes 1052
Brachysoma codeti, life history 1065
Bradley superior meat meal, analyses, Me .. 279
Bran, adulteration, N. C 278
and corn meal for pigs, N. H 967
fermented vs. unfermented for pigs, N. H 967
Brassica sp., notes, Vt 354
Brazos River flood of 1899, U. S. D. A .. 620, 698
Bread, adulteration, N. C 278
and bread making, studies, U. S. D. A . 767
milk, digestibility, Me 959
"antispire," analyses 481
making 478
digestibility 479, 661
Me 960
U. S. D. A 768
from different kinds of flour 970
flour and corn meal 1075

Page.

Bread, home-made, economy ... 970
  impurities ... 79
  making, losses, U. S. D. A ... 768
   with skim milk vs. water, Me ... 960
  ropy, studies ... 672
  slimy, notes ... 882
  "sticky" or "slimy," cause, Wis... 565
  water vs. skim milk, analyses ... 478
  wheat and whole-meal, analyses ... 661
Breakfast food, analyses, Idaho ... 314
Breed, effect on egg production, Utah ... 481
  vs. type in cows ... 86
Bremsergometer, description ... 777
Brewers' grains, dried, analyses, N. J. ... 777
   description ... 971
Brewery residue vs. peanut meal for milch cows ... 81
Brinjal affected by *Rhopalosiphum dianthi*. 1063
Brochymena annulata, notes, Mich ... 954
Brome grass, smooth, culture experiments, Nebr ... 240
Bromus inermis, analyses, Conn. Storrs... 882
   Minn ... 883
   Nebr ... 1031
  culture experiments, Nebr ... 240, 1030
  culture experiments, S. Dak ... 43
  hay, analyses, Can ... 873
  in Kansas ... 926
  notes, Colo. ... 339
   N. Dak ... 339
   U. S. D. A ... 1033
  varieties, Ala. Canebrake. 251
Broom corn, culture ... 240, 444
Brown-tail caterpillar, destruction by birds, U. S. D. A ... 953
  moth, distribution ... 100
Bruchophagus funebris, notes, Mich ... 954
Bruchus affinis, notes ... 562, 657
  chinensis, notes, U. S. D. A ... 470
  lentis, notes, U. S. D. A ... 470
  obtectus, notes, N. H ... 169
   U. S. D. A ... 470
  pisorum, notes, U. S. D. A ... 470
  quadrimaculatus, notes, U. S. D. A ... 470
  rufimanus, notes, U. S. D. A ... 470
Brunissure, nature and causes ... 59, 362, 466
Brussels sprouts, notes, S. C ... 1047
Bryobia prætiosa, notes ... 562, 652
Bryotropha solanella, notes ... 273
Bubonic plague, treatment ... 91
Buckwheat, analyses ... 724
  as an adulterant of flour ... 482
  ash analyses ... 38
  culture and uses ... 240
   studies ... 724
  fertilizer experiments ... 38
   requirements ... 724
  middlings, analyses, Me ... 971
  notes, Can ... 833
  root development ... 725
  water absorption of seed ... 1056
Bud selection in plant breeding ... 1047

Page.

Bud variation in plants ... [illegible]
Budding, winter, notes ... 937
Buds, winter growth ... 231
   killing, Vt ... 343
Buffalo beetle, notes ... 955
  bur, eradication, Wis ... 749
   notes, Okla ... 854
  gnat, southern, Miss ... 272
Buffaloes, distribution of galactase in milk, Wis ... 580
Bufo vulgaris, notes ... 429
Bugong moth, treatment ... 766
Bulb culture in Bermuda ... 52
   Holland ... 938
  diseases on the Pacific Coast, U. S. D. A ... 462
Bulbs, flowering, culture in Washington... 453
Bull nettle, notes, Okla ... 854
Burdock, eradication, Wis ... 749
Burette, automatic ... 511
  float ... 813
  holder ... 313
Burros, distribution of galactase in milk, Wis ... 580
Butter, adulteration ... 82, 87, 312, 811, 888, 1007
  analyses ... 905, 984
   Can ... 681
   Conn. State ... 770
   Ky ... 314
   Minn ... 883
   U. S. D. A ... 977
   Vt ... 389
  and margarin, manual ... 390
   method of differentiating ... 112
  as affected by air, light, and moisture ... 584
   corn ... 781
   food ... 888
    Miss ... 1080
   pasteurization at high temperatures 85
   sesame cake ... 281
   sugar-beet pulp ... 781
  Association of Ontario, report ... 788
  bacterial examination ... 977
  bitter taste caused by magnesia ... 587
  cause and prevention of mold ... 682
  chemistry and bacteriology, handbook ... 489
  composition as affected by foods ... 312
  control of flavor ... 285
  cryoscopy ... 618
  cultures, commercial, Pa ... 83
   U. S D. A... 599
  detection of cotton-seed oil ... 811
   margarin ... 888
  determination of boracic acid ... 510
   solids and fat ... 905
  digestibility ... 376, 659, 660
  estimation of rancidity from free volatile acids ... 584
  examination by the refractometer.. 618
   for tubercle bacilli ... 887
  exhibitions, Danish ... 85
   Finnish ... 188

Page.

- Butter exhibitions, Swedish, 87, 681
    - exports, 984
        - Danish, 87
        - U. S. D. A, 976
    - fat as affected by Penicillium, 977
        - composition as affected by food, Me, 974
        - physical and chemical constants, 308, 615
        - rancidity, 616
        - studies, 284
    - ferment, new, Del, 490
    - flavor and aroma as related to acid fermentation, Iowa, 388
    - from reindeer milk, analyses, 789
    - hardness, as affected by food, Me, 974
    - imitation, exports, U. S. D A, 976
    - imports into the United Kingdom, U. S. D. A, 976
    - inferior, improvement, 587
    - inspection, 380
    - making experiments, Can, 681
        - from heated milk, Pa, 84
        - in Canada, 1085
        - pasteurized milk or cream, U. S. D. A, 296, 976
        - treatise, 490
    - methods of analysis, 111, 311
    - preservation, 285
    - prices in New York and London in 1897, U. S. D. A, 976
    - production, cost, 490
        - in Canada, 490
    - quality as affected by food, Vt, 385
    - renovated, or process, detection, 83
    - renovating, 889
    - seasonal variations, 888
    - studies of rancidity, 616
        - on the Reichert number, 679
    - tubercle bacilli content, 387
    - typhus bacillus in, 786
    - unsalted, shipping trials, U. S. D. A., 976
    - variations in volatile fatty acids, 487, 975
    - water content, 188, 789
- Butterflies attacking fruit, Minn, 70
    - migration, 765
    - notes, 174, 371
- Buttermilk from Swedish creameries, analyses, 680
- By-products from chickens, utilization, 79
- Byturidæ, monograph, 562
- Cabbage black rot, notes, Vt, 56
    - butterfly, notes, 66
        - U. S. D. A, 952
        - imported, notes, N. H, 169
            - U.S.D.A, 952
    - club root. (*See also* Turnip club root.)
        - notes, Vt, 356
        - treatment, Vt, 56
    - insects affecting, 66
    - plant louse, notes, Can, 657, 863
        - U. S. D. A, 952
    - plutella, notes, 760
    - root maggot, notes, 66, 955, 957
        - Can .

Page.

- Cabbage rot, cause, Mass. Hatch, 552
    - webworm, notes, 369
        - U. S. D. A, 364
    - worm, remedies, N. H, 169
        - notes, 66, 955
- Cabbages as double crop with potatoes, 44
    - fertilizer experiments, 842
        - Mass. Hatch, 543
        - requirements, 250
    - nitrogen content of varieties, 451
    - notes, Ariz, 850
        - S. C, 1047
    - ridge vs. level culture, Ark, 244
    - varieties, 842
        - Ala. Canebrake, 251
        - Ark, 244
        - Mich, 250
        - S. Dak, 51
- Cacao affected by *Phytophthora omnivora*, 1061
    - culture, 548
        - in Brazil, 1048
        - Ecuador, 548, 744
    - disease in Trinidad, 556
    - etymology, 250
    - grafting, 548
    - notes, 352
    - pod disease, 166, 362
    - seeds, analyses, 1048
    - soils, analyses, 718
- *Cacœcia postvittana* attacking oranges, 561
    - *rosaceana*, remedies, 1065
- Cactus dahlias, notes, 453
- Caddice fly attacking lilies, Me, 958
- *Cæoma fumariæ*, genetic relationship with Melampsora of *Populus tremula*, 59
    - *saxifragæ*, notes
- *Cæsalpinia coriaria*, notes, 1037
- Caffein, effect on muscular work, 79
- Calabash fruit, analyses, 249
- *Calamovilfa longifolia*, notes, U. S. D. A, 423
- *Calandra oryza*, notes, U. S. D. A, 472
- *Calathea allouya*, analyses, 249
- Calcareous fertilizing materials, tests for, 506
- Calcium bisulphite as a clarifying agent, Ala. College, 293
    - carbide for phylloxera, 371, 1057
    - carbonate in soils, determination, 23, 110
    - determination of alumina in presence of, 613
    - in ashes, determination, 213
    - oxid, determination of carbon dioxid, 508
    - salts, physiological rôle, U. S. D. A., 1008
- Calf cholera, notes, Nebr, 393
    - epizootic occurrence of *Tænia cœnura*, 289
- California Station, notes, 1097
    - seed bulletin, 1047
    - University, notes, 1097
- Callalu, analyses, 249
- *Callidium sanguineum*, notes, 174
- *Callipterus giganteus*, notes, 657
- *Caloptenus italicus*, remedies, 658
- Calves, artificial milk for, 883
    - congenital tuberculosis, 394
    - cost of fattening, Nebr, 966
    - raising, U. S. D. A, 999

Page.
Calves, fall and spring, comparison 972
feeding, U. S. D. A.................. 296
experiments............... 80
Can.......... 666
Nebr.......... 966
N. H.......... 178
on milk of tuberculous cows, Conn. Storrs....... 890
feeds for...... 1077
for cultivating vaccine virus....... 195
skim milk for.......................... 480
tuberculosis.......................... 193
Camels, inoculation for glanders........... 290
susceptibility to cattle plague..... 289
Camembert cheese.......................... 588
Camnula pellucida, notes, Minn.......... 864
Camphor barometer, U. S. D. A.............. 430
culture in Florida................ 452
Camponotus pennsylvanicus, notes, Mich... 954
Canada field peas, analyses, N. J.......... 777
Pa.............. 436
culture experiments, Colo.................. 339
Cañaigre, culture experiments, Ariz........ 240
extract, studies, Ariz............ 213
fertilizer experiments, Ariz...... 240
Canals, State irrigation.................. 197
Canarsia hammondi, notes, Ky 170
Cancer, occurrence in domestic animals .. 291
organisms, pathogenic effects on animals.................. 91
Cane juice, analyses, Ky.................. 314
sugar, cost of production............ 536
determination of dextrose in presence of.................. 614
in milk, detection.............. 211
occurrence in ripe seeds....... 710
reducing power................. 306
tops, green, analyses................. 75
Canine distemper, biology................ 896
remedies, Va............ 190
Cankerworm, remedies...................... 558
spring, notes, Kans.......... 498
Nebr.......... 370
spraying experiments, N. Y. State 171
Cankerworms notes.... .... 173, 370, 957
Canna diseases, treatment, N. J........... 752
Cannas, varieties 852
Canned foods, preservatives in, N. C....... 960
goods, adulteration, N. C.... 971
meat bouillon analyses............ 882
meats, examination, U. S. D. A..... 67
Cantaloupe blight, notes, Colo............ 314
Cantaloupes, notes, S. C.................. 1047
varieties, Ala. Canebrake 251
Cantharis nuttalli, remedies, U. S. D. A..... 470
Caoutchouc, preparation for market........ 515
Capillarity effect on movements of ground water.................................. 517
Caprification as related to diœcism of the fig. 548
experiments in California, U. S. D. A................. 950
Caprifoliaceæ, notes........................ 870
Capulinia jaboticabæ, notes.............. 476
Caragana aborescens, new mildew.......... 261
Caraganas, varieties .... [illegible]
Caramel bodies, studies 1007
detection in spirits and vinegar.... 312
Carbohydrates, assimilation by plants...... 317
cleavage from protein....... 315
determination.............. 305
digestion by dogs.......... 778
Carboleum for San José scale, Ill.......... 655
Carbolic acid for milk fever............... 696
Carbon bisulphid as an insecticide......... 474
for aphides, Ohio........ 473
beet seed, Mich...... 955
"sickness"..... 262
manufacture and uses... 619
determination in nitrogenous organic substances.......... 311
dioxid, apparatus for determination in minerals............... 312
determination............. 213
in soils, determination..... 508
of the ocean as related to that of the atmosphere .. 622
fixation by leaves................ 1015
metabolism of, U. S. D. A........... 374
Carbonate of potash, analyses, Conn. State.. 719
R. I........ 917
soda. (*See also* Sodium carbonate.)
analyses, R. I...... 917
Carex alba, notes.......................... 353
Carissa ovata, poisonous to stock.......... 1057
Carnation rust, notes, Nebr............ ... 314
Carnations, breeding....................... 453
growing under glass all summer.......................... 937
insects affecting.............. 1065
new disease.................... 860
varieties....................... 154
Carneades scandens, remedies, Can........ 862
Carnivora, amylaceous digestion............ 778
Carob seed, composition of endosperm 1056
germination.................... 1056
Carpet beetle, black, notes........... 955
remedies, Mass. Hatch...... 561
grass, notes, Ala. College............ 154
Carpocapsa pomonella. (*See* Codling moth.)
splendana, notes.............. 766
Carrot rust fly, notes....................... 957
remedies.................. 559
Can............... 863
wild, amelioration by grafting...... 250
eradication, Wis.............. 749
notes, Vt....................... 354
Carrots, ash analyses......................... 38
culture 241
experiments, Can.......... 832
depth of planting, Can............... 631
fertilizing experiments............ 38, 842
Can........ 833
notes, Ariz......................... 850
S. C............................ 1047
nutritive value............... 73
varieties........................... 842
Can........................... 631
S. Dak...................... 51
Caryopsis of grasses, structure, U. S. D. A.. 423

Page.
Case moths, Australian, notes ... 658
Casein, analyses, Vt ... 818
    as affected by freezing ... 886
        micro-organisms ... 1085
    cause of change in pasteurized cheese ... 981
Caseon, digestibility ... 672
Caseous broncho-pneumonia of sheep ... 696
Cassava, analyses, Fla ... 377
    as a feeding stuff, Fla ... 376
    fertilizer experiments, Fla ... 334
    notes ... 1037
Cassavas, sweet and bitter ... 442
Cassia sophera, poisonous to stock ... 1057
Cassida bivittata, notes, Md ... 62
    nigripes, notes, Md ... 62
Castilloa elastica, as a source of rubber ... 1049
Castor-bean cake, analyses ... 137
    roots, ash analyses of soil from, Okla ... 277
Castor beans, varieties, Okla ... 1036
    oil plant, notes ... 287
    pomace, analyses, Conn. State ... 719
Castration, effect on excretion of phosphoric acid ... 483
Casuarina, notes ... 458
Catalpa sphinx, remedies ... 956
Catch cropping, history of practice ... 926
    crops, autumn, for green manuring ... 829
        culture ... 242
        selection ... 538
Caterpillar callalu, analyses ... 249
Caterpillars, destruction by birds, U. S. D. A ... 953
Cathartidæ, feeding habits ... 425
Cats, digestion experiments ... 874
    metabolism experiments ... 483
    red, immunity ... 712
Cattle, abortion ... 696
    breeding experiments ... 1076
    dehorning ... 894
    disease in Kansas, U. S. D. A ... 996
        not distinguishable from rabies ... 291
    feed mixtures, analyses, Minn ... 883
    feeding experiments ... 381
        Fla ... 376
    foot-and-mouth disease ... 695
    hygiene ... 592
    importation into Great Britain, U. S. D. A ... 999
    industry of Colorado, Wyoming, and Nevada, U. S. D. A ... 972
    inspection laws of various States and countries ... 591
    laryngeal syngamus ... 92
    maintenance ration, Pa ... 483
    measuring external conformation ... 577
    new parasitic disease in China ... 289
    of Hungary ... 381
        Kumaon ... 576
    plague, immunization ... 593
        in camels ... 289
            South Africa ... 695
            Turkey ... 593
        studies ... 192
Cattle plague, treatment ... 91, 898
    poisoning by *Macrozamia spiralis* ... 696
        moldy hay ... 796
        rape-seed cake ... 92
        reed meadow grass ... 796
    quarantine regulations, N. C ... 997
    ranges, renewal, U. S. D. A ... 220
    sterility, causes ... 289
    tick, notes, La ... 588
        Va ... 173
        of California, notes, Va ... 173
        prevalence in New South Wales, U. S. D. A ... 996
    ticks, remedies, U. S. D. A ... 491
    water on the joints ... 289
    young, cost of raising ... 1077
Cauliflower affected by *Plutella maculata* ... 1063
    leaf scorch, N. Y. State ... 1058
Cauliflowers, notes, S. C ... 1047
    varieties, Mich ... 250
        S. Dak ... 51
Cecidomyia destructor. (*See* Hessian fly.)
    taxi, notes ... 766
    tritici, notes ... 658, 1065
Cecropia moth, notes ... 955
    N. H ... 169
Celery, culture ... 51
    notes, Kans ... 498
        S. C ... 1047
    shading, N. J ... 752
    varieties, S. Dak ... 51
    wrapping in Florida moss ... 153
Cell division as affected by gases ... 120
    membranes, plasmolytic studies ... 1015
    physiology ... 424
    sap, red, occurrence in plants ... 121
    walls, experiments in staining ... 516
Cellar, winter, for bees ... 172
Cells, absorption ... 794
    living, chemical energy ... 814
    of vessels in plants ... 814
Cellulose enzyms ... 124
    estimation in feces ... 661
    hydrolysis by acids ... 20
    nutritive value ... 770
Cement, decomposition by bacteria ... 715
Cemiostoma coffeella, affecting coffee ... 1065
    scitella, remedies ... 956
Centaurea ragusina, notes ... 453
Central Moor Commission, proceedings ... 134
Cephalosporium lecanii, notes ... 275
Cephus pygmæus affecting cereals ... 1057
    notes, Can ... 862
    remedies ... 959
Ceratitis capitata, notes ... 760
Ceratomia catalpæ, notes ... 956
Cercospora beticola, notes, N. J ... 752
    N. Y. Cornell ... 163
    citrullina, notes, Ohio ... 357
    cucurbitæ, notes, Ohio ... 357
    resedæ, notes ... 465
    viticola on grapes ... 59
    vitis, notes ... 260
Cereal breakfast foods, U. S. D. A ... 599
    rusts, notes ... 361, 948, 1060
        N. Dak ... 817

Page.

Cereal rusts of the United States, U. S. D. A 942
  smuts, N. Dak 361, 817
Cerealine feed, description 971
  digestibility, Mass. Hatch .. 566
  vs. corn meal for pigs, Mass. Hatch 568
Cereals as affected by phosphoric acid 529
  food plants, advantages 970
  diseases 1057
  fertilizer experiments 230, 241
  fungus parasites 166
  geographical distribution 219
  germination 355, 361
  growth as affected by methods of seeding 442
  imported from Russia, U. S. D. A .. 319
  insects affecting 366, 765, 1062
    Can 862
  of Norway, composition 79
  subsoiling, Wyo 1026
Cerebro-spinal meningitis of the horse 697
Ceres Pulver for oat smut, R. I 944
Cerococcus ficoides, notes 563
Ceroplastes, parasite 1100
Ceroplastes roseatus, development 563
Cerotoma trifurcata, notes, U. S. D. A 952
  treatment, U. S. D. A 471
Cetonia floricola, notes 1065
  stictica in hotbeds, remedies 477
    notes 477
Cetonia, study 657
Chætocnema confinis, notes, Md 62
Chaff, analyses, Conn. State 777
  in foods and feeding stuffs, identification 672
Chagres River, ratio of discharge to rainfall, U. S. D. A 819
Chaitophorus maculatus, notes 957
Chalcididæ, classification 265
Chalk-plate maps, U. S. D. A 620
Champagne, "dry," analyses 906
Chararas graminis, treatment 765
Charcoal, management of forests for 457
Charlock, eradication 461, 856
Cheddar cheese, manufacture 285, 689
  pure cultures for 283
Cheese Association of Ontario, report ... 788
  bacteriology in Europe 285
  business, foreign, in Wisconsin 490
  Camembert 588
  causes of defects 1085
  Cheddar, manufacture 285, 689
    pure cultures for 283
  chemical studies on ripening 980
  chemistry and bacteriology, handbook 489
  coating, excelsior, Can 687
  colored spots in, U. S. D. A 984
  composition as affected by storing in damp cellars 978
  conditions of growth as affecting physiological activity of bacteria 389
  curing at different temperatures, Can 686

Cheese curing, cooperative experiments, Can 689
  curing rooms, construction 490, 686
    Can 689
    U.S.D.A 397
    Wis 186
  cooling, U. S. D. A ... 397
    Wis 186
  dipping at different stages of acid, Can 686
  diseases 790
  distribution of bacteria in 487
  Edam, industry in Holland 984
    ripening process 488
  effect of temperature in curing 1085
  Emmenthaler, lactic-acid ferments in 981
  exhibition in Sweden 790
  Gruyère, avoidance of "lainage" ... 1085
  making, Babcock test in 284
    experiments, Can 688
    losses in 790
    methods 490
    notes 1085
    on the farm 390
    problems 889
    pure vs. home-made cultures 87
    with pure cultures, U. S. D. A 296
      sour milk, Wis 585
  mottled, Can 687
  organism producing gas in, Mich ... 1086
  pressing curds at different temperatures, Can 686
  production in Canada 490
  regulations governing sale in Belgium 790
  ripening as affected by lactic-acid bacteria 981
  ripening as affected by temperature 490
  ripening, causes of changes 702
    function of lactic-acid bacteria 787
  Roquefort, effect of green particles. 788
    manufacture 390
  Stilton, manufacture 285, 490
  Tilsiter, experiments 788
  trade with Great Britain, U. S. D. A . 999
Cheimatobia brumata, notes 66
Chelymorpha argus, notes, Md 62
Chemical analysis, quantitative 812
  Control Station in Norway, report. 706
  energy of living cells 814
  Society, American, meeting 1100
Chemistry, agricultural, applications 1099
  methods of teaching 1000
  recent progress ... 419
  dairy, handbook 618
  evolution and achievements 617
  industrial, dictionary 618
    text-book 212
  medical, recent progress 618

Page.
Chemistry of chlorophylls 710
nutrition, manual 482
physiological and pathological 212
laboratory manual 509
text-book 79
plant and agricultural 617
Chermes abietis, notes 562, 657
funitectus, notes 657
laricis, notes 765
taxi, notes 766
Chernozem, explanation of vegetable origin 623
Cherries, analyses 1046
as affected by unusual cold, Ala. College 1041
bud development 851
effect of low temperature on blossom buds, Wis 930
fertilizer requirements 45
hardy stocks for 931
parasitic diseases 949
shot-hole effect 757
varieties 251, 850
Can 547, 844
Mass. Hatch 544
Mich 50, 153, 252
Mont 251, 1048
N. H 152
Okla 929, 1036
Cherry aphis, notes 562
Can 863
Ky 170
black knot, Colo 246
diseases, new 469
fruit fly, N. Y. Cornell 866
leaf beetle, notes, U. S. D. A 366
scorch, N. Y. State 1058
spot, notes, Ky 170
powdery mildew, notes, Colo 246, 314
sand, as a stock 451
for shade between forest trees 854
sawfly, remedies 766
Chestnut, climatic and fungus diseases 362
grafting, Conn State 742
trees, body blight, notes 362
weevils, remedies 563
Chestnuts, culture 453, 549
Japanese, variation in same variety 937
Spanish, insects affecting 765
treatment for *Marsonia ochroleuca*, N. J 752
Chicken by-products, utilization 79
cholera bacillus for destroying rabbits 1087
reaction in nutrient medium 794
Canadian 1092
differential diagnosis, U. S. D. A 983
immunization 495
symptoms 1092
transmission by insects 995
treatment 93
episootic bacillus, studies 495
in Italy 495

Page.
Chicken roup, serum therapy 594
tuberculosis, treatment 594
Chickens, breeds and crosses, Va 1074
feeding experiments 78
Can 880, 881
Mass. Hatch 572
N. C 1073
W. Va 774
skim milk for, Ind 277
Chicory, analysis 214
eradication, Wis 749
winter preservation 744
Chile saltpeter. (*See also* Sodium nitrate.)
injurious constituents 89
Chili sauce, analyses, Conn. State 769
"Chilinit," composition 1025
Chilocorus circumdatus, introduction into South Africa 760
similis, importation, N. J 761
tristis, importation, N. J 761
China aster diseases, treatment, N. J 752
grass, notes 340
Chinch bug, notes, Nebr 370
Ohio 472
outbreak in Ohio, U. S. D. A 952
Chinese primulas, breeding 453
vegetable food materials, U. S D. A 777
Chinosol, antiseptic power 496
Chion cinctus, notes, U. S. D. A 366
Chionaspis americana, notes, Iowa 958
citri, remedies 372
furfurus, notes 274
Iowa 958
U. S. D. A 952
on American fruit 655
ortholobis, notes, Iowa 958
pinifolii, notes, Iowa 958
salicis, notes, Iowa 958
Chionaspis, monograph 476, 563
notes 476
Chiropachys colon, notes, Mo 268
Chizocerus zabriskei, notes 871
Chloral, effect on tetanus 192
Chlorids, alkaline, surface tension 112
loss in incinerating 304
Chlorin, determination 106
occurrence in cotton seed oil 619
of soil, assimilation by plants 132
value as a fertilizer, R. I 914
Chlorophyll assimilation as affected by green coloration of leaves 513
of *Limodorum abortivum* 119
criticism of certain investigations 814
formation as affected by anesthetics 119
Chlorophylls, chemistry 710
Chlorops lineata, notes 658
Chlorosis, treatment 469, 946
Chocolate, adulteration 970
analyses 970
Cholesterin, formation and combustion 576
in egg yolk 882
Chorizagrotis agrestis, notes, Mont 267

Page.
Chramesus icoriæ, notes, U. S. D. A 952
Christmas rose, classification 852
Chromates as preservatives for milk 984
Chroococcus helveticus on greenhouse plants. 906
Chrysanthemum diseases, treatment 469
N. J. 752
rust, treatment, Mass., Hatch 552
treatment, N. J 946
Chrysanthemums, diseases and parasites 469
for winter blooming 52
varieties, Can 644
Chrysobothris femorata, notes, Mo 268
sp., notes 1063
Chrysomela suturalis, notes, Mich 954
Chrysomelidæ, estivation 656
Chrysomphalus ficus, notes 958
minor, notes 958
Chufas, analyses, Okla 277
Churn, so-called air 984
to prevent overchurning 87
Churning as affected by pasteurization 680
experiments 85
Mich 186
Churns, tests 285
Can 689
Vt 389
Cicada, periodical, notes 477
seventeen-year, notes 477, 870
Cicada septendecim, notes, U. S. D. A 952
Cicadas, remedies 478
Cicuta maculata, notes, N. Dak 287
Cider apples, washing 294
as affected by preservatives 1100
Cigarette beetle, remedies, U. S. D. A 472
Cigars, efflorescence 515
Cimbex, study 657
Cinerarias, breeding 453
Circumnutation, rate 818
Cirrhosis of the liver, notes 995
Citrus fruit pomace, analyses 381
fruits, fertilizer for 744
insect enemies 657
trees, verrucosis 861
Cladochytrium violæ, n. sp 261
Cladosporium fulvum, notes, N. J 752
Clams, culture 80
U. S. D. A 599
Clania lewinii, notes 658
"Clariphos" as clarifying agent, Ala. College 293
Clasterosporium amygdalearum, notes 465
Clay-colored weevil, remedies 766
in soils, determination 903
Clematis, notes 650
Clerus formicarius, notes, W. Va 475
Clianthus dampieri, culture 549
Climate and crop—
conditions, changes in forms for reporting, U. S. D. A 127
report, Alaska, U. S. D. A 129
service in Porto Rico, U. S. D. A 430
publications, U. S. D. A 127, 429
summaries, U. S. D. A 430
work, U. S. D. A 621
Climate and plant growth in Argentina 821
as related to sap pressure 118

Page.
Climate, effect on various forest [illegible] .... [illegible]
diameter increment of conifers .... [illegible]
of Alaska, U. S. D. A 31
Cuba, U. S. D. A 30
Mexico 31
Oklahoma 1017
Porto Rico, U. S. D. A 30
St. Lawrence Island, U. S. D. A. 819
the Isthmus of Panama, U. S. D. A .... 517, [illegible]
Kongo 126
photochemical of arctic regions 126
studies, U. S. D. A 127
vs. weather, U. S. D. A 222
Climatic data, interchange, U. S. D. A 127
Climatology of Canada, U. S. D. A 430
Panama, U. S. D. A 430
Clisiocampa americana, notes, Can 868
N. H 169
disstria, notes, Can 868
Mich 954
N. H 169
U. S. D. A 962
Clostridium butyricum, notes 255
licheniforme, effect in ripening cheese 787
Clotbur, eradication, Wis 749
Clothes moths, notes 955
Cloud names, international, U. S. D. A 222
observations, international, U. S. D. A 620, 621
in Victoria 222
studies in Sweden 129
Clover, alsike, analyses, Can 617
Pa 436
as a cover crop, Can 844
crimson, analyses, Pa 436
and rye, analyses, N. J 777
as a cover crop, Mich 1047
culture, U. S. D. A 926
for green manure, Ariz 833
sowing in different months, N. H 145
fertilizer experiments 1027
Mass. Hatch. 530
R. I 641
growth as affected by light 815
hay, red, nutritive value 73
vs. alfalfa for lambs, Can 666
inoculation experiment, Can 816
insects affecting 563
leaf beetle, remedies, Mass. Hatch 561
mammoth, analyses, Can 617
plaster as a fertilizer 230
red, American vs. Bohemian seed 1037
analyses, Can 617
Pa 436
culture in Kansas 927
diseases, Mich 59
resowing 44
root mealy bug, notes 957
rowen, analyses, Conn. Storrs 882
seed, alsike, viability 157
crimson, tests, U. S. D. A 748
viability 157

Page.

- Clover seed impurities, Vt 353
  - midge, remedies 559
  - red, viability 157
  - weed seed in 1054
    - Mich 54
  - white, viability 157
- treatment for Orobanche 159
- varieties, Can 632
  - Mich 43
- vs. rape for pigs, Wis 570
- water absorption of seed 1056
- white, analyses, Pa 436
  - water absorption of seed 1056
- Clovers and grasses of different regions, comparison 156
  - culture experiments, S. Dak 43
  - for green manuring, Ariz 254
    - Can 832
    - the South, notes 241
  - notes, La 28
    - N. Dak 339
- Coal, analyses, Idaho 314
  - Ky 314
  - ash analyses, Idaho 314
  - tar dyes, detection in food products 1100
  - Wyoming, analyses, Idaho 314
- Coccidæ, notes 274, 476
  - of Ceylon 476
    - western Australia 871
- Coccidia, life history 658
- Coccidium, life history 658
- Coccids, fatal temperature, U. S. D. A 953
- *Coccinella 7-punctata*, notes 765
  - *transversoguttata*, notes, U. S. D. A 470
- Coccinellidæ, monograph 562
- *Coccus cacti*, notes 958
  - *lacca*, notes 958
- Cochineal insect, notes 477
- Cochylis, remedies 174, 372, 565
- Cockchafer, notes 562
- Cocklebur, eradication, Wis 749
  - notes 858
- Cockroaches, notes 955
- Cocoa, adulteration 970
  - beans, analyses 970
  - culture in Samoa 352
  - palms affected by spotted locusts 477
  - shells, analyses, Can 873
- Cocoanut cake for cows 1084
  - trees, culture 745
- Cocoons of silkworm races, properties 178
- Codling moth, notes 66, 476, 565, 760, 765, 766, 955, 957, 1064
  - remedies 371, 558, 765
    - Colo 370
    - U S. D. A 296
  - spraying experiments, Ill 258
- *Cœlostoma immane*, notes 958
- Coffee, adulteration 970
  - N. C 278, 971
  - analyses 744
    - Conn. State 769
  - as a food protector 970
  - bark louse 1065
  - beans, Kentucky, analyses, Mo 1008

Page.

- Coffee compounds, analyses, Conn. State 769
  - culture in Paraguay 240
    - Porto Rico 144
    - Queensland 144, 744
  - manual 352
  - disease and nitrogen hunger 1061
    - in Nicaragua 362
  - diseases 166, 261, 469, 1060, 1065
  - grafting 548
  - husks, analyses 971
  - hybrid 240, 449
  - hybridization 452
  - insects affecting 1065
  - leaf disease, treatment 1060
    - rot, treatment 1069
  - pruning 51
  - roots, nematodes 262
  - shade trees for 744
  - substitutes, analyses, Conn. State 769
  - trees, nursery management 1048
    - peaberries on 744
    - pruning 851
- Coke, analyses, Ky 314
- *Colaspis brunnea*, notes, U. S. D. A 952
- Cold Friday, date, U. S. D. A 619
  - storage for eggs 482
    - fruit 350
      - Kans 349
    - onions 153
  - waves in the Southwest, U. S. D. A 620
    - of atmosphere, depth, U.S.D.A 222
- *Coleophora lutipennella*, notes 766
  - *nigricella*, notes 765
- Coleoptera, notes 370
  - zonal distribution, N. Mex 956
- Coleus, varieties, Can 644
- Coli bacilli, effect on growth of typhus bacilli 393
- Colic of horses, notes 394
  - treatment 191
- *Colletotrichum camelliæ*, notes 948
  - *lindemuthianum*, notes 254
  - *violæ-tricoloris*, n. sp 257
    - treatment 553
- *Collops bipunctatus* affecting potato beetle 767
- Colon bacilli in oysters 427
- *Colopha ulmicola*, notes, U. S. D. A 952
- Colorado College, notes 199, 600
  - Station, financial statement 396
    - notes 199, 600
- Coloring matter, artificial organic, detection 1007
  - reagents, use with microscope 1016
- Colydiidæ, monograph 562
- Comb honey, production 271
- Compost fertilizers, value 157
- Compositæ, subterranean organs 121
- Compound cakes, analyses 971
- *Compsomyia* (*Lucilia*) *macellaria*, notes, Miss 272
- Condenser, new form 313
  - Soxhlet reflux 814
- Confectionery, manufacture 278
- Congress and irrigation 195
- Conidia formation as affected by inorganic salts 424

Page.
Conidia formation in *Aspergillus niger* 710
fungi 710
Conifer seed, studies 355
seeds, histidin and lysin in 1056
Conifers, diameter increment as affected by climate 515
occurrence of root suckers 940
ornamental, disease 949
Conium maculatum, poisonous to cattle 796
Conjunctiva, absorption of virus 697
Conjunctivitis, treatment with protargol 496
Connecticut College, notes 297
State Station, financial statement 799
notes 297, 600, 899
Storrs Station, financial statement 897
Conopholis americana, notes 817
Conotrachelus nenuphar, notes, Ga 173
U. S. D. A 952
Convolvulus arvensis, notes, Iowa 651
Cooking in the public schools of New York City, U. S. D. A 79
Copper acetate for grape downy mildew 256
tomato downy mildew 259
carbonate, ammoniacal, preparation 861
content of plants 1012
fungicide containing potassium permanganate 166
fungicides, adherence 168
and soap mixtures, combination 1060
increasing adhesiveness 1061
preparation and comparison 60
variation in composition 168
in plants 24
salts for preserving railroad ties 1052
sulphate for charlock 461
grape black rot 758, 759
Peronospora 362
smuts of cereals 361
solution, preparation and use, Mass. Hatch 174
weak solutions as fungicides 861
transmission from food to milk 587
Coprinus atramentarius, notes, N. Y. Cornell 322
comatus, notes, N. Y. Cornell 322
micaceus, notes, N. Y. Cornell 322
Coprinus, glistening, notes, N. Y. Cornell 322
Coptocycla bicolor, notes, Md 62
clavata, notes, Md 62
signifera, notes, Md 62
Corimelæna extensa, notes, U. S. D. A 472
Cork oak, production 747
tissues of certain roots, structure 818
Corn and barley vs. molasses feed for pigs 69
cane, culture experiments, S. Dak 43
cob meal for cows, Miss 1079
cowpea field, grazing with steers, Ark 965
oat chop, description 971
feed, analyses, Me 279

Page.
Corn, analyses [illegible]
Me 971
N. J 777
as affected by anesthetics 1056
nitrogenous fertilizers 529
nitrogenous fertilizers, Conn. Storrs 836
an adulterant of flour 483
article of diet in Servia 481
Bedouin, notes, Mich 1037
bran, analyses 381
breeding, Kans 496
by-products as a feeding stuff 381
classification of varieties, U. S. D. A 423
crop of Hungary, 1899, U. S. D. A 598
crushed cotton-seed meal for, Ark 926
culture, Can 642
N. C 497
experiments, Can 832
Colo 339
Ind 335
Md 440
Mich 40
N. Dak 332
S. C 834
manual 443
development as affected by latitude 120
economic value 926
effect on quality of butter 781
fertilizer experiments 44, 335
Can 632, 833
Conn. Storrs 836
Ga 39, 1030
Ind 335
Mass. Hatch 529
S. C 834
fodder, analyses, Minn 883
N. J 777
Okla 277
for silage, analyses, Conn. Storrs 882
germination, studies 355
germs, analyses, Me 971
green, forcing, N. H 146
manuring, Ark 921
ground, for cows, U. S. D. A 999
hybridization experiments, R. I 928
irrigation experiments, Wis 538
kernel, improvement of chemical composition, Ill 633
meal, analyses, Conn. State 279
Me 971
meal and bran for pigs, N. H 967
vs. barley meal for pigs 72
cerealine feed for pigs, Mass. Hatch 568
hominy meal for pigs, Mass. Hatch 568
whole corn for pigs, N. H 968
W. Va 774
methods of harvesting, Ga 1030
notes, Mich 1037
nutritive value 381, 576
oil, detection in cotton-seed oil 814
plant, feeding value, U. S. D. A 397
planting and replanting, U. S. D. A 296
at different distances, Ga 39, 1030

Page.

- Corn, planting at different distances, Tex ... 233
  - plants, manual ... 423
  - pollination ... 706
  - root system, N. Dak ... 215
  - rust, notes, U. S. D. A ... 943
  - secondary effect of pollen ... 1016
  - silage. (*See* Silage.)
  - soaking, for pigs, W. Va ... 774
  - soils, studies ... 1100
  - starch content, as affected by storing ... 293
    - in wheat flour, detection ... 311
  - stover, analyses, Conn. Storrs ... 882
    - N. J ... 777
  - temperatures for germination ... 1056
  - undigested, analyses, N. J ... 777
  - utilization in manufacture ... 733
  - varieties ... 144
    - Ala. Canebrake ... 240, 251
    - Can ... 633
    - Colo ... 339
    - Ga ... 39, 1030
    - Mich ... 43
    - N. Dak ... 332
    - Okla ... 1036
    - Tex ... 233
  - vs. barley and oats for cows ... 780
    - for pigs, Minn ... 177
    - corn-and-cob meal for cows, N. J ... 784
      - meal for pigs, Wis ... 571
    - palm-nut meal for pigs ... 70
    - peas for lambs, Can ... 666
      - steers, Can ... 665
  - water absorption of seed ... 1056
  - white, analyses, Minn ... 883
  - worm. (*See* Bollworm.)
  - yellow, analyses, Minn ... 883
- Corncob meal vs. ear corn for pigs, N. H ... 968
- Corncobs, analyses, Minn ... 883
  - N. J ... 777
  - ash analyses, Conn. State ... 719
- Cornell University, notes ... 899
- Cornstalk disease, notes ... 592, 995
  - Nebr ... 393
- Cornstalks, analyses, N. J ... 777
  - reducing and invertible sugar in ... 904
  - sugars ... 112
  - waste in feeding, N. J ... 783
    - U. S. D. A ... 999
- Corrosive sublimate for potato scab, Iowa ... 651
- *Corthylus columbianus*, notes ... 764
- Cossus, study ... 657
- *Cossus tristis*, notes ... 760
- Cotton affected by *Oxycarenus lugubris* ... 1063
  - Allen Hybrid, Ark ... 926
  - black rust, remedies, Ala. College ... 139
  - boll weevil, eradication ... 273
  - bollworm (*See* Bollworm.)
  - cost of production, U. S. D. A ... 41
  - crushed cotton seed vs. cotton-seed meal for, Ark ... 926
  - culture, N. C ... 497
    - experiments, Ala. College ... 139
      - Ga ... 138
      - Tex ... 439
    - in the German colonies ... 842

Page.

- Cotton culture, manual ... 643
  - Egyptian varieties ... 120
  - fertilizer experiments ... 725
    - Ala. College ... 139
    - Ga ... 138
    - S. C ... 233, 835
    - Tex ... 439
  - flowers, coloring matter ... 511
  - green manuring, Ark ... 921
  - hull ashes, analyses, Conn. State ... 719
    - Mass. Hatch ... 528
    - Tex ... 438
  - in Egypt, insects affecting ... 563
  - oil, notes ... 294
  - plant, history ... 144
  - residual effects of fertilizers, Ga ... 1030
  - sea island, analyses, S. C ... 918
  - seed and its products, U. S. D. A ... 397
    - olive oils, differentiation ... 23
    - cake, analyses ... 971
    - crushed vs. cotton-seed meal for various crops, Ark ... 926
    - disease ... 592
    - for cows, Miss ... 1079
      - pigs ... 1072
    - meal, adulteration, N. C ... 278
      - analyses ... 381
        - Conn. State ... 279, 719
        - Conn. Storrs ... 882
        - La ... 39
        - Mass. Hatch ... 138, 528, 1026
        - Me ... 279, 971
        - N. J ... 777
        - R. I ... 917
      - availability for grass, Conn. State ... 722
      - for cows, Miss ... 1079
        - Tex ... 280
    - oil, adulteration ... 814
      - as a butter adulterant ... 83
      - food ... 672
      - detection in butter ... 1007
        - lard ... 811
      - mills, construction and operation ... 294
      - occurrence of chlorin and absence of sulphur ... 619
    - products, value ... 294
    - products vs. barnyard manure, S. C ... 233
    - value to the farmer, Miss ... 1069
  - subsoiling, Ala. College ... 139
  - upland, analyses, S. C ... 918
  - varieties ... 144
    - Ala. Canebrake ... 240
    - Ala. College ... 139
    - Ga ... 138
    - N. C ... 1032
    - Okla ... 1036
    - S. C ... 439
    - Tex ... 438
  - wilt disease, U. S. D. A ... 944
- Cottonwood, broad leaf, notes, Mont ... 1051
  - narrow leaf, notes, Mont ... 1051
  - notes, Can ... 858

Page.
Cotyledon ventricosa as a cause of disease in goats 493
Cover crops for green manure 538
glasses, fixing films, N. J 714
Cow cabbage, varieties, Can 682
Cowpea and corn field, grazing with steers, Ark 965
fodder, analyses, Conn. Storrs 882
vine hay, feeding value, Tenn 1076
weevil, notes, U. S. D. A 470
wilt disease, U. S. D. A 944
Cowpeas, acquisition of nitrogen, N. C 497
analyses, N. J 777
as affected by nitrogenous fertilizers, Conn. Storrs 837
ash analyses, La 231
composition, Mo 1076
culture, N. C 497
" experiments, Colo 339
curing for fodder, N. C 497
for green manuring, Ariz 254
soil improvement, Ala. College 232
notes, Ariz 239
N. Dak 339
value and use, U. S. D. A 145
varieties, Okla 1036
Cowpox, notes 995
virus, history of culture at the Utrecht Veterinary Institution 693
Cows, abortion, treatment 88, 192, 289, 495
N. J 791
amount of food consumed, Mo 1078
breeding and care 1084
breeds, U. S. D. A 983
conformation 188, 888
cost of raising, N. H 178
distomatosis of the abdominal walls 289
distribution of galactase in milk, Wis 579
economical foods for 983
feeding 188
different quantities of grains, N. J 884
experiments. 81, 86, 284, 484, 587, 675, 780, 885, 888, 983, 1081
Can 688
Mass. Hatch 577
Miss 1079
N. C 1078
N. J 784, 884
N. Y. Cornell 1081
Tex 280
manual 789
flaxseed vs. linseed cake for 578
fly mixtures for, Can 689
for restoring fertility, U. S. D. A 397
forage and soil crops for 587
formation and improvement 86
gestation, U. S. D. A 599
H. O. dairy feed for 983
Holstein-Friesian, tests 284
management 489, 688, 983
metabolism experiments 484
methods of testing, S. C 198
milk fever 288
milking two and three times a day, Can 674
Page.
Cows, parturient apoplexy, treatment 894
period of gestation, N. Y. Cornell 81
railroad fever 289
richness of milk in mountain breeds. 185
selection, Kans 496
soiling crops for, N. J 783
spaying 789
stables for 489
stall for 285
stalls and ties for 389
tests 587, 888
Ariz 896
type vs. breed 86
vaginitis, cause and treatment 192, 289
value as related to weight 789
of breeds 284
winter rations 284
Crab apples as stocks for common apples, Wis 930
Siberian, as a stock for common apples, S. Dak 848
varieties, Mont 251, 1048
grass hay, digestibility, N. C 277
notes, Okla 354
Cracklings and hoof meal, analyses, N. J 830
ground, for poultry, Me 279
Crambus caliginosellus, notes, U. S. D. A 952, 953
Cranberry fireworm, remedies 957
U. S. D. A 951
fruit worm, remedies 957
soils, studies, N. J 718
spanworm, remedies 957
Crane flies affecting grasses 1066
remedies 263
Craniophora (*Acronycta*) *ligustri* var. *olivacea*, notes 1065
Cream, analyses, Conn. State 769, 770
bacterial content, Iowa 388
determination of fat content 812
of tartar, analyses, Idaho 314
pasteurized, for butter making, Can 681
raising by dilution, U. S. D. A 599
Vt 389
ripening experiments, Can 681
ropiness, N. Y. Cornell 282
separators, tests 490
Mich 186
use of patented, N. Y. Cornell 389
studies 790
vs. milk, germ content 786
Creameries, disinfecting, Mich 391
Creamery building at Hoorn 389
Creaming, notes 889
Creatinin, physiological effect, U. S. D. A 374
Cremastogaster rogenhoferi affecting tea 1062
Creolin, effect on anthrax 894
test for glanders, N. Dak 889
Crepidodera rufipes on tares 767
Crescent oat feed, analyses, Me 279
Cresols, germicide power 697
Cricetus frumentarius, notes 371
Crimson clover. (*See* Clover, crimson.)
Crioceris asparagi, notes, N. J 762
U. S. D. A 952

Page.

Crioceris 12-punctata, notes, N. J 762
U. S. D. A 962
Crop bulletin for Quebec 698
circulars, U. S. D. A 397, 698, 898
production, importance of amount and distribution of water, Wis 537
reports for Manitoba 999
Crops and live stock in Ontario 698
as affected by neighboring plants 1036
preceding growing season, U. S. D. A 819
weather 911
related to soil moisture 129
fertilizer requirements, Mass. Hatch 137
U. S. D. A 999
foreign, statistics, U. S. D. A 397
sampling, experimental error, Vt 307
Cross fertilization, effect on endosperms 1016
Croton, notes, Okla 354
Crows, notes 428
Crude fiber, pentosan-free, determination 704
Cryoscopy of butter and margarin 618
Cryptogams, syllabus of study 1099
vascular, occurrence of lignins 819
Cryptolæmus montrouzieri, importation in California 558
Cryptomyces aureus, notes 467
Cryptophaga unipunctata on cherry trees 562
Cuba, climate, U. S. D. A 30
fauna 427
Cucujidæ, monograph 562
Cucujus coffeophagus affecting coffee 1065
Cucumber anthracnose, treatment, N. J 752
beetle, notes 955
striped, notes, Ga 864
N. Y. State 270
U. S. D. A 364
downy mildew, treatment, Ohio 357
flea-beetle, notes, Md 62
U. S. D. A 365
wilt, notes, Mass. Hatch 553
Ohio 357
Cucumbers, cost of spraying, N. Y. State 257
effect of pruning on fruit production, Mass. Hatch 552
forcing in deep and shallow benches 734
fungus diseases, Mass. Hatch 552
fusarium wilt, Ohio 357
notes, S. C 1047
spraying experiments, N. Y. State 270
varieties, Mich 250
S. Dak 51
yield on old and new land, N. J 753
Cucurbit anthracnose, notes, Ohio 357
downy mildew, notes, Ohio 357
new 51
wilt, notes 465
Cucurbits, insects affecting, Ga 864
manuring 1047
pollination 220
Culex albopunctatus, notes 957
annulatus, notes 957
Culex elegans, notes 957
fcalbii, notes 957
glaphyropterus, notes 957
hortensis, notes 957
impudicus, notes 957
malariæ, notes 957
mimeticus, notes 957
modestus, notes 957
nemorosus, notes 957
ornatus, notes 957
penicilliaris, notes 957
pipiens, notes 957
pulchritarsis, notes 957
richiardii, notes 957
spathipalpis, notes 957
vexans, notes 957
Culinary encyclopedia 183
Cultivation, adaptation of methods to physical properties of soils 805
effect on moisture content of soil, U. S. D. A 127
productiveness of soil 643
Culture, effect on soil 32
media for bacteria, preparation 122
tube, filling, N. J 714
Cultures, artificial soils for 514
Curculionidæ of Australia 957
Curds, gassy and tainted, U. S. D. A 296
Currant, black, gall mite, notes 272
leaf blight, notes 167
spot, notes, Ky 170
Zante, culture 650
in South Australia 548
Currants, analyses 1046
culture experiments, N. J 735
fertilizer experiments 1039
N. J 735
fruit development as affected by seed development 936
irrigation 1039
experiments, N. J 735
notes, Mont 251
red, preservatives for exhibition purposes, Can 649
spraying experiments, Wis 150
varieties 251, 850, 1048
Can 547, 644, 844
Mass. Hatch 544
Mich 153, 252
Okla 929
Pa 452
Wis 150
white, preservatives for exhibition purposes, Can 649
Cuscuta, destruction 750
new species on alfalfa 1057
studies 462
Cuscuta gronovii, notes 462, 750
monogyna on grapes 159
Cutworms, notes 66
remedies, Can 862
Md 62
Mont 267
Cyanotis axillaris, analyses of seed 575
Cycloconium oleaginum, notes 59, 362
treatment 554

Page.
Cyclones, mechanics 716
notes, U. S. D. A.................... 432
Cyclonic storms, U. S. D. A.................. 429
Cyclopodia horsfieldi, n. sp., notes............ 871
Cylas formicarius, notes, Md 62
Cyllene pictus, notes, Ohio 63
Cynara scolymus, culture, U. S. D. A......... 1047
Cynarase, new formation..................... 888
Cynodon dactylon. (*See* Bermuda grass.)
Cyperus rotundus, notes 750
Cypripedium, monograph 454
Cystococcus humicola on greenhouse plants 906
Dactylis glomerata. (*See* Orchard grass.)
Dactyloctenium australiense, n. sp., notes... 709
Dactylopius affecting citrus fruits.......... 657
Dactylopius brevipes, notes.................. 1065
bromeliæ, notes 1065
citri, notes, U. S D. A........... 472
destructor, notes, Iowa. 958
longifilis, notes, Iowa 958
longispinus, notes 1065
Dacus oleæ, notes........................... 558
Daffodils, color as related to soil composition 319
Dahlia, diseases, treatment, N. J 752
Dahlias, decorative and cactus 453
Dairy agent in Manchester, England, report 788
and the weather, U. S. D. A 620, 819
barn, description, Wis 595
buildings, construction... 295
Commissioner of Iowa, report....... 188
exhibit at Toronto, Can 689
herd record, Can 688
Me.......... 983
Mich 188
N. H 188
N. J.................... 883
Vt 383
testing, Del 486
tests, Wis......... 673
industry and typhoid fever, N. Dak. 817
inspection in Belgium 788
New York............ 489
institute at Proskau, report 788
institutions in the United States, U. S. D. A 390
laws of Iowa 188
physics, investigations, Can......... 687
products, analyses 23
rules, U. S. D. A 984
salt, analyses, Minn 883
studies, U. S. D. A .
Wis 585
sanitation 390
service, bacteriological examinations for 979
utensils, sterilization 188
Dairying and bacteriology 688
stock raising, manual....... 86
as related to beet-sugar industry 535
cooperative in Belgium 489
eastern vs. western 587
handbook 284
in Denmark............... 188, 489, 789
Scotland, U. S. D. A .
Dairying in Sweden as affected by the mechanical skimming method.. 490
the Caucasus 88
Victoria, manual 898
notes, Okla 1084
practical hints 888
recent progress 788
sanitary aspects 984
Dairymen and farmers, handbook for 883
books for 999
Dairymen's convention in Sweden.......... 790
Daisy, oxeye, eradication, N. H............ 159
Wis 749
notes, U. S. D. A 599
white, eradication, Wis 749
notes, Vt...................... 354
yellow, notes, Vt..................... 354
Darnel, cause of poisonous effects........... 906
Dasychira pudibunda, notes 870
Datana integerrima, notes, U. S. D. A 952
Date palm in United States, U. S. D. A..... 290
palms, notes, Ariz.................. 239, 253
varieties, Ariz.
Dates, analyses, Ariz 850
Datura leichhardtii, poisonous to stock 1057
Deadly nightshade poisoning, treatment... 495
Decimal notation of time 1076
Dehiscence of nutmeg fruit 121
Dehorning, notes 894
Okla..................... 1070
Va 191
Delaware Station, financial statement...... 496
Dematium pullulans, spore formation.... 122, 322
Dendroctonus frontalis, notes 763
W. Va....... 475
simplex, notes 763
Denitrification in soil 32
of manures in the soil 830
processes in nature 33
studies 831
Depressaria persicæella, notes, Mich 954
n. sp., notes, Mich . 954
Derecho of Ohio, U. S. D. A 430
Dermacentor americanus, notes, La 588
Va........ 173
occidentalis, notes, Va..... ... 173
Dermatitis, pustulant...................... 291
Dermatology, recent progress.......... ... 392
Dermestes vulpinus, notes.................. 767
U. S. D. A 472
Desmodium tortuosum, notes, U. S. D. A .. 339
Desiccators, shelf.......................... 212
Devon cattle, notes, U. S. D. A 983
Dewberries, notes, Mont................... 251
Dextrin as reserve material in plants 216
Dextrose, determination in presence of cane sugar 614
Diabrotica longicornis, notes, U. S. D. A 952
12-punctata, notes 1100
U. S. D. A 471, 472, 952
vittata, notes, Ga................ 864
U. S. D. A...... 364, 952
Diapromorpha melanopus affecting tea 1062
Diarrhea in young pigs, etiology 1092
Diaspidiotus, North American species 657

Page.

- *Diaspis amygdali*, notes, Ga 368
  - Ohio 63
  - *calyptroides* var. *cacti*, notes 1063
  - *fallax*, notes 870
  - *lanatus*, remedies 958
  - *rosæ*, notes, Iowa 958
    - remedies 958
- Diastase, proteolytic, of yeast extract 715
- Diastases in urine, determination 23
- *Diatræa saccharalis*, notes, U. S. D. A 952
- *Dicyphus minimus*, notes, U. S. D. A 471
- Diet book 278
  - in ancient times 183
- Dietaries for hospitals for the insane 971
  - of prisons in Scotland 575
- Dietary studies in eastern Virginia, U. S. D. A 961
  - studies in the United States, U. S. D. A 482
  - study of a bicycle rider 375
- Dietetic preparations of recent origin 672
- Dietetics and dietetic treatment, handbook 380
  - with reference to diet in disease 380
- Digestion as affected by formaldehyde 575
  - experiments, artificial 661
  - pancreatic and peptic 576
- Digestive canal as affected by toxins and antitoxins 194
- Digitalis for diagnosing pericarditis traumatica of cattle 289
- *Dillenia speciosa*, uses 549
- *Dindymus versicolor*, notes 558
- *Dinoderus substriatus*, notes, U. S. D. A 954
- Diphtheria of fowls, treatment 697
  - reaction in a colored nutrient medium 794
- *Diplosis pyrivora*, notes 169, 272, 765
  - *tritici*, notes, Can 862
    - U. S. D. A 952
- Diptera, notes 870
- Director, report, Ariz 295, 897
  - Ark 295
  - Colo 396
  - Conn. Storrs 897
  - Del 496
  - Ind 396
  - Ky 396
  - La 295
  - Md 295
  - Me 998
  - Mich 98, 1095
  - Minn 396
  - Miss 897
  - Mo 1095
  - Mont 295, 1095
  - N. C 1095
  - N. Dak 898
  - Nev 898
  - N. J 799
  - N. Mex 599
  - N. Y. Cornell 898
  - N. Y. State 295
  - Okla 1096
  - Pa 496
  - R. I 998
  - S. C 1096
  - Tex 1096
  - Utah 496, 1096
  - Vt 397
  - Wash 898, 998
  - Wis 599
  - W. Va 698
  - Wyo 1096
- Dirt, volumetric determination in milk 1007
- Diseases caused by Rhyzoctonia 57
  - contagious, incubation period as related to sale of animals 892
    - of animals, notes 893
  - infectious, and bacteriolytic enzyms 194
    - as related to unsanitary conditions, Mich 390
  - of animals, manual 591
    - transmission by insects 995
  - bulbs on the Pacific coast, U. S. D. A 463
  - farm animals, State compensation for loss 591
  - rôle of insects in spreading 561, 693
  - treatment by light 1090
- Disinfectants, notes 998
- *Disonycha xanthomelæna*, notes, U. S. D. A 365
- *Dissosteira carolina*, notes 265
  - *longipennis*, notes 265
- Distemper and rabies, differentiation 896
  - canine, remedies, Va 190
- Distillation apparatus, fractional 511
  - new 112
- Distillery feeds, dried, analyses, Ky 314
  - vinasse as a fertilizer 1025
- *Distoma hepaticum* in the spleen of sheep 797
  - notes 997
  - *lanceolatum*, notes 997
- Distomatosis, notes 997
  - of the abdominal walls of the cow 289
- *Ditopella fusispora*, notes 467
- Divi-divi, culture 1037
- Dock, sour, eradication, Wis 749
- Docks, notes, Vt 354
- Docophorus, notes 263
- Dodder in American clover seed 462
  - clover and alfalfa seed 750
- Dog flea, notes 263
- Dogs, digestion experiments 380, 778
  - epizootic catarrhal fever 191
  - growth as affected by composition of milk 576
  - metabolism experiments 276, 381, 483, 672, 778, 883, 962, 973
- *Dolerus arvensis*, notes, Ohio 63
  - *collaris*, notes, Ohio 63
- *Dorcadion lineatum*, affecting cereals 1057
- *Dorcaschema alternatum*, notes 272
  - *wildii*, notes 272
- *Dorylaimus condamnus*, notes 259, 712
  - *incertus*, notes 712
  - *makrodorus*, notes 712
- *Doryphora decemlineata*, notes 273

Page.

Doryphora decemlineata, notes, U. S. D. A.. 952
Doticus pestilens, notes. 558
Draft of broad and narrow tired wagons... 1094
Drainage and irrigation, manual 826
waters, analyses, Mass. Hatch.... 525
Dried blood, analyses, Conn. State 719
La 89
Mass. Hatch 138
Minn 831
N. J 830
R. I 917
effect on growing rye in presence of phosphates, Mass. Hatch 526
Drones, parthenogenetic origin 657, 956
Drosera binata, notes 937
filiformis, hybrids 817
intermedia, hybrids 817
Drought, effect on milk 676
Drying oven, electric 313
Ducks, breeding and rearing 80
breeds 972
feeding, U. S. D. A 999
experiments, Can 671
Dundee corn-and-oat feed, analyses, Me 279
Dust in atmosphere, U. S. D. A 222
whirls and fairy dances, U. S. D. A. 222
Dutch Belted cattle, notes, U. S. D. A 983
Duty of water, instructions to observers, U. S. D. A 798
Dwarfing experiments with plants 548, 910
Dysentery of calves 995
Earcockle, treatment 759, 948
Earias insulana, notes 563
Earth and atmosphere, radiation of heat... 132
Earthquakes, recent, U. S. D. A 221, 429
Earthworm as a cause of gapes in poultry. 892
host of gapeworm 191
Earthworms, studies 429
Easter lilies, growing with electric lights 937
Echinococcus veterinorum, notes 290
Eclampsia in domestic animals 696
Ecology of Kansas grasses 420
sand dunes of Lake Michigan.. 321
Eczema, notes 794
Edam cheese, nature of ripening process. 488
Edema albifrons, notes, N. H 169
Edestin in metabolism of dogs 778
investigations 310
Education, agricultural, development 999
Effervescent wines, manufacture 157
Egg albumen, studies 705
fertility, experiments, Can 671
production as affected by—
age of fowls, W. Va 776
various factors, Can 881
Mass. Hatch 572
Utah 481
production experiments, Can 881
nitrogenous vs. carbonaceous rations for, W. Va. 774
records, individual, method of obtaining, Me
yolk, phosphorus compounds.
Eggplant flea-beetle, notes, U. S. D. A 365
Eggplants, extent of disease on, N. J 752

Page.

Eggplants, notes, Ariz 856
S. C 1047
varieties, S. Dak 61
yields on old and new lands, N. J 758
Eggs, cold storage for. 482
flavor as affected by food, N. C 1073
hen's, effect of freezing on the embryo 577
incubation as affected by ammonia.. 1093
methods of preserving 862
Can 679
N. Dak 279
U. S. D. A 599
selling by weight, N. C 1078
Elachista coffeella, affecting coffee 1066
Elastin, value in metabolism experiments.. 672
Electric conductivity of culture media as affected by bacteria 715
light, effect on leaf tissues 708
use in growing Easter lilies. 937
Electricity as related to plant growth, Mass. Hatch 552
atmospheric, diurnal variation.. 432
effect on germination of seed. 355, 462
oxygen content of water 133
plants 25, 1016
for seasoning wood 855
in agriculture 598, 926
of the air and lightning U. S. D. A.
static, effect on roots 907
Electrolytes, mutual solubility of certain pairs 1099
Electrolytic determination and separations. 510
dissociation 710
Elm leaf beetle, notes 66
Conn. State.
scale, notes, Conn. State 762
tree parasite, notes 467
twig girdler, life history 1066
white, cost of planting, Can 854
Elymus arenicolus, n. sp. notes, U. S. D. A.. 28
Embryo sacs, development 818
Emphysema, pulmonary, with chronic bronchitis, diagnosis 1091
Empretia stimulea, notes, Mich 954
Empusa aphidis, notes 564
aulicæ, notes 67
fresenii, notes 564
phalangicida, n. sp., notes 361
Emulsin as affected by borax 962
Endive, winter preservation 744
Endocarditis, notes 290, 794
Endoglobular hæmatozoa of sheep 797
Endomychidæ, monograph 562
Energy, conservation in the human body.. 576
metabolism of, U. S. D. A 874
production by sugar 184
Enological station in Spain, report.
Ensiling, new method 644
Entero-hepatitis, differential diagnosis, U. S. D. A 985
Entometa ignobilis, notes 658
Entomologic service, voluntary, in New York State, U. S. D. A 951

Page.
Entomological notes from California 1100
Canada 1100
Colorado 1100
station in Italy, origin and work 475
of Sweden 66
Society of Washington, proceedings 264
Entomologist of Cape of Good Hope, report 759
Ceylon, report 273
Colorado, report 270
Dorpat, Russia, report 272
Norway, report 765
Sweden, report 66, 172, 675
West Java, report 370
Entomology, applied, in the Old World 265
economic, progress during the nineteenth century 1099
Entomophthora australis, notes 766
planchoniana in Italy 275
Environment, effect on color of insects 870
development of grapes 52
Enzym in Spiræa 715
of Nepenthes, proteolytic 124
yeast, alcohol-producing 123
Enzyms as affected by formaldehyde 125, 511, 715
bacteriolytic, and immunity 194
effect on germination of seeds, Vt 354
of cellulose, notes 124
seeds, distribution 125
Ephestia kuehniella, notes, U. S D. A 952
remedies 871
Epicærus imbricatus, notes, U S D. A 364
"Epicarin" effect on mange mites of dogs 870
Epicauta vittata, notes, U. S. D. A 952
Epicometis hirta, notes 563
Epiderm of leaves, mucilaginous 116
Epilachna borealis, notes, U. S. D. A 362
corrupta, notes, U. S. D. A 470
Epilepsy in domestic animals 696
Epitrix cucumeris, notes, U. S. D. A 365
fuscula, notes U. S D A 365
parvula, notes 871
U. S D. A 365, 471
Equine distemper, Va 495
Eragrostis lutescens, n sp notes, U. S. D. A 28
Eremophila maculata, poisonous to stock 1057
Ergot as cause of contagious abortion 495
Ergotism, notes 92
Nebr 393
Eriocampa limacina, notes 766
Eriocampoides limacina, notes 657
Eriococcus paradoxus var. *indica*, notes 1063
Erotylidæ, monograph 562
Erysimum repandum, notes, Nebr 315
Erysipelas of the pig, treatment 290
transmission by insects 995
Erysiphe graminis affecting cereals 1057
martii, notes, N. J 752
Erythrosin as an indicator 311
Ether and the atmosphere, U. S D A 620
extraction apparatus 214
use of incandescent lamps 420
Eucalypti of Arizona 855
Eucalyptus botryoides, notes 747
Page.
Eucalyptus corynocalyx, notes 1052
globulus affected by *Phylacteophaga eucalypti* 564
in foothill region of California 941
maculata, notes 747
melliodora, notes 1052
microcorys, notes 747
platyphylla, notes 747
resinifera, notes 747
robusta in foothill region of California 941
rostrata, notes, Ariz 855
tereticornis, notes 1052
tesselaris, notes 747
Eucalyptus, classification of species 458
trees, notes 1052
Eucharis, culture 549
Eucomia ulmoides, as a rubber-producing plant 1049
Eudamus proteus, notes, U. S D. A 470
Eudemis botrana, notes 367
U. S. D. A 952
Eumerus lunulatus, affecting potatoes 1057
Euphoria inda, notes, U. S. D. A 365
Euproctis latifascia affecting tea 1062
Eupsalis minuta, notes 764
Eurotia lanata, notes, U. S. D. A 1034
Euschistus variolarius, notes, U. S. D. A 472
Evaporation of fruits, U. S. D. A 452
Evergreen leaves, starch content in winter 910
new 938
trees, transpiration in winter 910
Evolution of plants, treatise 318
Exartema fasciata, notes, U. S. D. A 952
permundana, notes, U. S. D. A 952
Exercise, effect on egg production, Utah 481
Exoascus deformans, notes 59, 260
Mass. Hatch 552
N. Y. Cornell 164
pruni, notes, Colo 246
Exochomus nigromaculatus, introduction into New South Wales 760
Exorista heterusiæ, notes 958
Experiment station—
and botanic garden, established in Kongo Free State 1000
at Chojnowo, Poland 299
Ploti, reports 197
Spalato, report 198
exhibit at the Paris Exposition 601
for milling 299
in Brussels, report 497
Russia, report 98
pomological, at Gratz, report 157
Record, editorial management 2
Rothamsted, report 842
notes 99, 199, 297, 398, 499, 600, 699, 800, 899, 1000, 1097
work, practical value, Mo 898
Experiment stations—
for poultry culture 484
in foreign countries, list, U. S. D. A 98
international cooperation in methods 310
irrigation work 195
object and purpose 401

Experiment stations—Continued. Page.
of Germany, at the Paris exposition ... 506
conditions and needs 506
the United States, statistics, 1899 .. 397, 801
work and expenditures, U. S. D. A. 98
Extraction apparatus 23, 511
Eye disease as affected by illumination of stables 893
Fagopyrum esculentum aptera, analyses. .. 724
Falconidæ, feeding habits 425
Fall webworm, notes 272
Nebr 370
remedies, N. H 160
Farcy, transmission to man 288
Farm accounts, methods of keeping, Mich .. 698
animals in Denmark 999
manual 80
recent losses, U. S. D. A 397
statistics, U. S. D. A......... 998
crops, cost of production, Mich 43
protecting from insects and fungi 959
superintendent, report, Can.......... 642
Farmer and expansion, U. S. D. A 397
Farmers and fruit growers' guide 45
books for 999
institutes in Ontario, report 198
Wisconsin 296
reading courses. U. S. D. A 999
Farming in North Carolina 497
Farms and farmers, English, U. S. D. A 497
Fat absorption 883
analysis, acetyl value 811
content of butter, studies 308
cream, determination 812
milk as affected by
fat in rations 484
feeding fat, Me 975
quantity of food 184
milk, determination...... 311, 510
rape seed as affected by soil and fertilization 141
determination by Gerber method, possible error 813
formation by intensive feeding of fat .. 674
from protein 483, 883
in the body 1076
globules as affected by freezing........ 886
condition in milk and cream .. 1100
of milk, studies.............. 186
in condensed milk, determination...... 1100
diet of dogs 276
meat, determination................. 21
milk and butter, determination 905
determination 213, 419, 904
of butter, studies 284
milk, source.... 284
transformation into glycogen.......... 184
Fatigue, effect on milk, Vt 384
Fats, apparatus for determining melting point............................. 419
determination of melting point 312
Fatty acids, iodin number.................. 813
of butter, study 312
volatile, of butter, variations 487, 975
Fauna of Cuba............................ 427

Page.
Fauna of Tres Marias Islands, U. S. D. A .. [illegible]
Feces, ash analysis, Mo 1004
composition and fuel value, Mo 1076
thermal value, Mo.. 1006
estimation of cellulose 661
loss of nitrogen in drying, Mo....... 1005
Feed, effect on milk and butter, Miss....... 1080
Feeding, modern, handbook 483
periods, proper length, Vt 382
standards, value to the farmer.... 971
Feeding stuffs—
adulteration, N. J 777
analysis methods in Belgium and Holland................................ 104, 810
compilation of analyses, N. J 777
control law 777
determination of fiber, Mo.............. 1006
"freshness"......... 506
protein 418
digestibility, N. C 483
for horses, nutritive value............... 79
supplementing pasturage........... 779
identification of chaff in 672
inspection.............................. 380
Me 971
N. J 777
Vt.......................... 482
recent investigations 882
Feeding tests, experimental error, Vt...... 382
Feeds, composition and thermal value, Mo. 1006
fertilizing constituents recovered, Miss 1022
Feijoa sellowiana, description of fruit...... 48
Feltia subgothica, notes, U. S. D. A 471
Ferment, soluble, reducing nitrates in animals 715
Fermentation—
alcoholic, relation to aromatic principles 125
without yeast cells........... 713
as affected by oxygen 122
bacteria in 125, 714
effect on feeding value of hay 479
inorganic, analogy to true fermentation 706
manual 715
nature and control, N. J 125
of olives 125
red beets 715
tobacco........................... 341
U. S. D. A 727
wine, mannitic 126
study 126
without yeast.............. 715
Ferments, alcoholic, physiology and morphology 125
dissemination in soil 227
effect on germination of old seed. 460
in wine diseases.............. 715
manual.......................... 715
oxidizing in phænogams 715
soluble 715
Ferns, culture............................. 550, 650
of South Dakota 817
propagation......................... 745
Fertility in sheep, causes, N. J 793
of soils, studies................... 130
Fertilization of flowers 709

Page.
Fertilization of flowers, Me 369
Fertilizer analysis, alkaline permanganate method, Vt 330
  methods in Belgium and Holland 104, 810
Fertilizer constituents of soils, assimilability 138
  control in Missouri, Mo 1025
    North Carolina, N. C . 1095
    Sweden 39
  experiments in Austria......... 1026
    Russia.......... 35
    methods for conducting, S. C..... 198
    on crop rotations .. 1027
    muck land, Mich 1037
    summary 230
      Pa....... 438
  formulas for fruit trees......... 451
    special crops.......... 831
    uses and abuses....... 1099
  industry of Alabama............ 1026
    recent progress 831
  law of Indiana 438
    South Australia.......... 138
  laws, Conn. State 719
    Ky...................... 137, 627
    La 39
    Me 137
    Mich..................... 528
    Miss 528
    N. J 720
    Pa 917
    S. C 438 831
    Tex 438
    Wis..................... 138, 528
    W. Va....... 34
  resources of Alabama............ 1026
  trade in Connecticut..... 719
    Mississippi 528
    Missouri 1025
    New Jersey.......... 720, 830
Fertilizers, ammoniacal, on calcareous soils 330
  analyses 23, 229, 314, 438, 527, 831 917
    Ariz 213
    Can 617, 831
    Conn. State 719
    Ky 137
    La 39
    Mass Hatch 137, 528
    Me................. 137, 829
    Mich 528
    Miss 39, 229, 528
    Mo.................... 1025
    N. C 229
    N. H 138
    N. J 830
    N. Y. State........... 917
    R. I 438, 627, 1026
    S C 438, 831
    Tex 438
    Vt 328, 437
    Wis................ 138, 528
    W. Va............... 34, 438
  availability of organic nitrogen N. J 720
Fertilizers, availability of organic nitrogen, Vt........................... 328
  chemical, tests..................... 1026
  chemistry, text-book 418
  complete, analyses, Mass. Hatch 1026
  compost, value 157
  cooperative experiments, means of encouraging 506
  determination of ammonia 506
  effect on composition of crops, Vt................. 336
    development of potato scab, N. H....... ... 256
    fat content of rape seed................. 141
    fertility of soil....... 331
    mosaic disease of tobacco 359
  for asparagus 351
  home mixing, N. C.............. 497
    Ohio 228
  inspection Mass. Hatch 528
    Me 137, 917
    Mich.................. 528
    N. H 138
    R. I 438
    Vt 437
  liquid, analyses, Mass. Hatch . . 528
  phosphatic 229
  sampling, S. C 831
  text book 331
  trade in different States, N. C 229
    values, Mo........... 1025
  treatise 138
  use 926
    in spring 230
  valuation... .. .. 229, 438, 527, 917
    Conn. State 719
    Ky.................... 137
    Mass. Hatch 137
    Miss. 39, 229, 528
    Mo 1025
    N. C 229
    N. J............ 830
    R. I 438, 627, 1026
    S. C 438, 831
    Tex 438
    Vt 437
    W. Va 34, 438
    Wis 138, 528
Fertilizing constituents of feeds recovered, Miss 1022
  soils, utilization 228
Fescue, meadow. (*See* Meadow fescue.)
Fever, epizootic catarrhal, of dogs.......... 191
  malarial, in horses 290
  of fowls 291
  railroad, of cows................. 289
  splenic.................. 193
Fiber in feeding stuffs, determination, Mo 1006
Fibrin, crystallized 814
Ficus macrophylla affected by ***Gallerucea semipulata*** 561
Fidia viticida, notes, U. S. D. A............. 962

Page.
Field crops, breeding 44
of Nebraska, diseases 468
protecting, from insects and fungi 959
culture, handbook 483
experiments in Belgium 239
England 240
peas, experiments with Nitragin, Mass. Hatch 516
notes, N. Dak 339
Fig branch borer, notes 173
diœcism as related to caprification 548
mildew in Campania 59
Figs as affected by unusual cold, Ala. College 1041
caprification experiments, U. S. D. A 950
Films, fixing to cover glasses, N. J 714
Filtering bulbs, dust proof, N. J 714
Filtration of fruit wine 157
Finger-and-toe disease, remedies 555
Fir, Douglas, disease 262
notes 747
occurrence of root suckers 940
red, analyses, Idaho 314
Fire warden law in Minnesota 459
Fish, analyses, Conn. State 719
as food 777
ground, analyses, N. J 830
guano, analyses 79
meal, analyses 79
scrap, analyses, La 39
Fishery Congress, proceedings 80
Fistula, milk 288
treatment with protargol 496
Flat lands of North Germany, soils 434
Prussia, soils 435
pea, analyses, Pa 436
notes, U. S. D. A 219
Flax, culture 443
experiments, Can 833
in Germany as related to Russian flaxseed 145
Russia 443
fertilizer experiments 42
growing with wheat 644
industry in Sweden 240
meal, analyses, Mass. Hatch 528
Cleveland, analyses 381
Conn. Storrs 882
Me 279, 971
N. J 777
and fine rowen hay, digestibility, Conn. Storrs 874
vs. linseed meal for lambs, Mass. Hatch 566
digestibility, Me 965
retting 240
root system, N. Dak 215
seeding at different rates 42
Flaxseed, analyses, Minn 883
vs. linseed cake for cows 578
Fleabane, notes, Okla 354
Flea beetles, notes 273
Fleas, ground 174
notes 263
systematic position 173
Flesh flies, notes 263
notes 263
Floats, analyses, La 89
R. I 917
S. C 1024
Flood conditions in the James River Valley, U. S. D. A 490
of January, 1880, in St. Kitts, U. S. D. A 490
Floods and flood problems, U. S. D. A 620
as affected by forests 432
Flora of Europe, spontaneous hybrids 120
North Carolina 909
North Dakota 817
the Tres Marias Islands, U. S. D. A 428
Florida beggar weed, notes, U. S. D. A 339
Florida Station, notes 99
velvet bean, culture, N. Dak 241
Flour, adulteration 211, 482
N. C 278, 971
analyses, Conn. State 769
"Best Patent," analyses, Can 882
detection of sawdust 905
for bread making, examination 79
Hungarian, analyses, Can 882
impurities 79
testing by chemical methods 1100
Flower bulbs, culture in Washington 453, 1049
culture in Holland 938
farms of California 1049
gardens of Japan 1049
growing under glass in England 650
Flowering of sugar cane, effect on sugar content 146
Flowers, annual, for home grounds, N. Y. Cornell 49
bacteria in 713
coloring matter 29
colors as related to bees 271
edible, notes 482
effect of removal on nitrogen assimilation of legumes 516
fertilization 709
Me 909
laws regulating formation of sex 910
photographing 154
Fluids, flow through porous media 518
Fluorin, determination 106
in wine, detection 813
Fodder, coarse, function in feeding 772
crops, mixed, notes, Can 833
green, grain mixtures for, Can 632
hygienic value 592
plants for Victoria 214
Fog dispeller, U. S. D. A 221
effect on plants 1016
utilization, U. S. D. A 222, 430
Food consumption in abnormal work 375
effect on butter 888
and butter fat, Me 974
fat content of milk 184
milk 86

Page.

- Food, effect on milk fat, N. Y. Cornell, 1081
  - quality of butter, Vt, 885
    - milk, 489
  - materials, methods of examining, 482
    - of America, composition, U. S. D. A, 379
  - nutrients, and food economy, U. S. D. A, 777
  - plants of Australia, 1015
    - warm countries, 444
  - popular article on, 183
  - preparations, analyses, 672
    - color analysis, 813
  - preservatives, analyses, Minn, 812, 883
    - Boron, 184
  - products, detection of coal-tar dyes, 1100
  - requirements of persons on expeditions, 575
  - substances in trees, winter condition, 117
    - manual of analysis, 618
- Foods, adulteration, 184, 312, 970
  - analyses, 814
    - Minn, 812
  - detection of saccharin, 312
  - determination of protein, 418
    - purity, 213
  - for infants and invalids, analyses, 672
  - identification of chaff in, 672
  - microscopical examination, new slide for, 313
  - preserved, manufacture, 278
  - Swiss, official methods of examination, 1075
- Foot-and-mouth disease—
  - destruction of the contagion in manure, 92
  - disease resembling, 795
  - immunization experiments, 92
  - in Sweden, 495
  - inoculation experiments, 696
  - lymph inoculations, 695
  - notes, 793
    - U. S. D. A, 995
  - outbreak, 796
  - treatment, 192, 495
- Foot rot in Montana, 1092
  - treatment, 392
- Forage crops, culture experiments, Colo, 339
  - for cows, 587
    - sheep, 184
  - in the South, U. S. D. A, 397
  - notes, Mich, 1037
- Forage plants. (*See also* Grasses.)
  - cooperative experiments, U. S. D. A, 1032, 1033
  - for alkali soils, U. S. D. A, 423
    - summer pasture, Nebr, 279
    - the South, U. S. D. A, 539
  - imported from Russia, U. S. D. A, 319
  - notes, La, 28
    - Nebr, 315
  - of Wurttemberg, 43
  - pot experiments, 32
  - syllabus of instruction, 1099
- Forbes scale, remedies, Ill, 654
- Forcing asparagus, 450
  - cucumbers in deep and shallow benches, 734

Page.

- Forcing grafted roses, 151
  - grapes, 745
  - head lettuce, U. S. D. A, 296
  - industry in France, 153
  - lettuce, 1039
  - pineapples, 352
  - plums, 352
  - pole beans, N. H, 147
  - rhubarb, 51, 649
    - R. I, 645
    - U. S. D. A, 999
  - sweet corn, N. H, 146
  - tomatoes, 1039
- *Forda vacca*, notes, 765
- Forecasting, long-range, present status, U. S. D. A, 429
  - of weather, U. S. D. A, 223
- Forecasts, dissemination, 1018
- Forest areas, denuded, restoration by pasturage, 941
  - clearing, effect on rainfall and temperature, U. S. D. A, 127
  - conditions and management in Germany, 1050
    - of Porto Rico, U. S. D. A., 853
  - culture, advisability, 458
  - domain of Belgium, 747
  - economy, principles of, 1050
  - influences, 1050
  - insects, studies, 366, 1063
  - leaves, analyses of water extract, Mass. Hatch, 188
  - legislation in Colorado, need of, 458
  - management in British India, 1050
  - preservation, relation to the public welfare, 458
  - problem in the West, 941
  - problems in the United States, U. S. D. A, 454
  - ranger system of the United States, 854
  - reserves, national, 195
  - resources of the United States, 1050
  - thinnings, problems, 941
  - tree seeds, scattering by mammals, 712
  - trees as affected by climate, Va, 455
    - decay, 458, 1052
    - important, of the United States, 1050
    - notes, Mont, 1051
    - of Cambre, parasites, 950
      - Europe, notes, 942
      - India, fungi, 950
    - stand as affected by light, 458
  - vegetation as affected by alkali, 434
- Forestry Association, American, meeting, 1100
  - of Massachusetts, 459, 942
  - bills introduced into Congress, 1050
  - Commissioner of Pennsylvania, report, 941
  - conditions and changes in Wisconsin, 1050
    - in the United States, 1050
  - cooperative experiments, Can, 644
    - work, U. S. D. A, 745
  - Department of Russia, report, 54
  - development during the last twenty-five years, 1099

Page.
Forestry Division, work for the farmer, U. S. D. A 457
  experiment stations 457, 747
  experimental, in Russia 747
  in Bengal 457
    Bosnia and Herzegovina 747
    Canada 845
    New South Wales 457
    Russia, century summary 53
    the Adirondacks, U. S. D. A 938
      United States, résumé 457
    wooded and treeless regions, U. S. D. A 454
  investigations of the U. S. Department of Agriculture, review 1050
  legislation of Switzerland 459
  movement in the United States 1050
  plantations, height growth 941
  practical 941
  primer, U. S. D. A 855
  profession 457
  report, Mich 53
  school at Yale University 900
  schools of Europe 1052
  science 434
  situation in Santa Monica, Cal 941
  State 1051
  working plans for different estates 941
Forests and snow fall, U. S. D. A 221
  distribution and classification 1050
  effect on floods 432
    precipitation and water conservation 718
    storage reservoirs 1052
    underground water 826
    water supply 940
  extent of injuries by sheep 748
  growth of reserve trees after lumbering 941
  management for charcoal production 457
  model for Scotland 457
  mountain, restoration 455
  natural reproduction in old fields 928
  necessity of preservation 940
  of Cape of Good Hope 1051
    Dean 457
  pure vs. mixed 941
  resinous, in France, treatment 1052
  uniformity of systems 940
Formaldehyde as a disinfectant 767, 893
    milk preservative 582, 587
  detection in milk 213, 418
  determination 419
      in free and combined state 705
  effect on digestion 575
    enzyms and proteids 125, 511, 715
  formation in plants 1015
Formalin, effect on germination of fungi and growth of bacteria 469
  for grain smuts, Ohio 162
    potato scab, Ind 356

Page.
Formalin for potato scab, Ky [illegible]
    preserving milk, Okla [illegible]
    wheat and oat smut, Ind [illegible]
  in milk, determination [illegible]
Foul brood, legislation 870
  treatment 172
    Mich 61
Four-o'clock seed, analyses, Conn. Storrs [illegible]
  wild, Nebr 365
Fowl cholera, treatment [illegible]
  fever [illegible]
Fox, flying, notes, U. S. D. A 426
  pine sawfly, notes 272
Foxtail, meadow. (*See* Meadow foxtail.)
Fraxinus excelsior, cultivation 942
Freeze of 1899, effect on nurseries and orchards in the Northwest, Wis [illegible]
    in Iowa 549
    the South 158
Freezes, light, effect on grapes 31
Freezing, effect on embryo of hens' eggs 577
    feeding stuffs 576
    milk 886
  excessive, effect on orchard fruits, Ala. College 1041
Fridericia agricola attacking grass 564
Frit fly, American, notes, Can 562
  notes 66
    N. Dak 264
  remedies 175
Frontina armigera, notes, Ohio 63
  frenchii, notes, Ohio 63
Frost butterfly, notes 66
  effect on different varieties of peaches 252
    fall plowed land 44
  fighting, U. S. D. A 127
  injuries to trees 515
  of June 30, 1899, in Ohio, U. S. D. A 620
  prediction and avoidance of injuries, U. S. D. A 129
  prevention by radiant heat, U. S. D. A 429
  protection against, U. S. D. A 819
    by root pruning 153
    experiments, U. S. D. A 222
    from, U. S. D. A 517
  warnings and protection 821
Frosts and the strawberry crop, U. S. D. A 819
Fruit bark borer, notes, Ga 173
  chafer, brown, U. S. D. A 365
  cold storage 350
    Kans 349
  crystallized and glacéd 549
  culture and geology 744
    in North America 152
    manual 251
  development as affected by Bordeaux mixture 262
  flavor 250
  fly, Mediterranean 563
    notes 760, 870, 958
    Queensland 563
  growers, books for 909
  growing under glass in England 650
    irrigation 1048
  industry in Australasia 547

Page.

- Fruit industry in Chile 536
    - Nova Scotia 451
  - inspection 66
  - maggot flies, remedies 273
  - persistence of types under cultivation 152
  - pulp, exports from Canada 547
  - raising in the United States 50
  - reasons for not setting, Kans 498
  - rots, studies 164
  - stations for instruction 744
  - tree culture, studies 451
    - insects, studies 366
    - mildews, notes 949
  - trees along highways 851
    - as affected by crude petroleum, N. J 868
    - chlorosis 946
    - deciduous, crown gall, Ariz 858
    - dwarf, advantages 251
    - failure to set fruit 154
    - fertilizer formulas 451
      - requirements 45
    - gum flow 758
    - injuries by fungicides 862
    - insect and fungus diseases 272, 370
    - inspection 368
    - manuring 251
    - old, treatment 153
    - root pruning, U. S. D. A 599
    - winter protection, Mont 251
    - wood-boring insects 173
  - wine, filtration 157
  - worm, gray, notes 957
- Fruits, asbestos as a packing material 549
  - breeding 851
  - butterflies and moths attacking, Minn 170
  - classification 113
  - dried American, infestation with scale insects 656
  - evaporation, U. S. D. A 452
  - evergreen, pruning 1047
  - flowering periods, Va 128
  - forcing, in France 153
  - *Fusicladium dendriticum* affecting 1057
  - hardiness in Iowa 252
  - insects affecting 1057
  - methods of preservation 453
  - native of Northwest Canada 547
  - notes, Can 850
  - of Oregon 851
  - orchard, fertilizer experiments 1039
      - N. C. 341
    - irrigation 1039
    - varieties for Rhode Island 937
  - pomaceous, pollination, U. S. D. A 447
  - preservation 937
    - for exhibition purposes, Can 649
  - preservatives for 549
  - principles of breeding 851
  - pruning and spraying experiments, Can 547
  - ratio of perfect to abortive forms 818
  - Russian, tests, Iowa 647
    - varieties 547

Page.

- Fruits, scoring 252
  - small, fertilizer experiments, N. C 341
    - notes, Can 850
    - varieties for Rhode Island 937
  - surplus, utilization, U. S. D. A 452
  - varieties recommended for the United States and Canada, U. S. D. A 544
- *Fumea nitidella*, notes 766
- Fumigation of orchards, Cal 64
- Fumigator for hydrocyanic-acid gas, U. S. D. A 951
- Fungi affecting ornamental trees and shrubs 477
  - as affected by certain chemicals 910
    - ethereal oils 168
    - light 321
  - related to weather, N. J 754
  - Australian, catalogue 321
  - biological species and races 322
  - conidia formation 710
  - decomposition of glucosids 322
  - edible and poisonous 649
    - of Japan 1075
  - effect on form and characters of plants 121
  - filamentous, development as affected by deleterious substances 910
  - fleshy, in greenhouses 424
  - germination as affected by formalin 469
  - new species 361
  - of forest trees in India 950
    - middle Europe 424
  - parasitic, as affected by wet weather 469
    - biology 322
    - of Vermont 356
  - rust, culture experiments 360
    - duration of winter spores 59
  - wood frequenting, biology 322, 516
- Fungicide, adhesive 262
  - and insecticide, new 60
  - containing potassium permanganate 166
  - new 651
  - powders, apparatus for applying 263
- Fungicides—
  - copper, and soap mixtures 1060
    - increasing adhesiveness 1061
  - effect on mustard 462
  - for grape black rot, comparative studies 357
  - powdered vs. liquid 60
  - preparation and use 60, 262, 478, 565
    - Ill 258
    - Mass. Hatch 174
    - N. C 659
    - N. J 753
    - R. I 262
- Fungus disease of iris bulb 360
  - diseases, combating 57
    - notes 259
    - of cultivated plants 59, 361
    - grapes 362
    - sugar beet, N. Y. Cornell 162
  - parasites of cereals 166

Page.

Fungus parasites of cultivated Rosaceæ ... 166
  grasses ... 166
Furfuroids, distribution and biological importance in the soil ... 818
  function in sugar beets ... 321
  physiological importance in plants ... 121
Furfurol, formation from starch ... 619
Furnace slag, effect on sugar beets ... 540
Fusarium affecting asters ... 261
Fusarium roseum, notes, Ohio ... 161
Fusel oil in alcoholic liquids, determination ... 318
Fusicladium dendriticum. (*See* Apple scab.)
Gadflies, remedies ... 653
  U. S. D. A ... 950
Galactase, distribution in cows' milk, Wis. ... 579
  properties, Wis ... 578
Galeruca, estivation ... 656
Galeruca semipulata on leaves of *Ficus macrophylla* ... 561
Galerucella, estivation ... 656
Galerucella cavicollis, notes, U. S. D. A ... 366
  luteola, notes, U. S. D. A ... 952
Gales, northwest, of the southern Blue Ridge and Piedmont region, U. S. D. A ... 221
Gall formations, classification ... 562
Gapeworms of poultry, notes ... 495
  remedies ... 191, 392
Garbage, disposal in foreign countries ... 831
Garden and greenhouse plants, insects affecting ... 765
  crops, fertilizers for, U. S. D. A ... 509
  flea hopper, notes, U. S. D. A ... 364
Gardens, irrigation ... 547
Gas lime, valuation ... 528
Gases, effect on protoplasm and cell division ... 120
  stomata ... 115
  intestinal, collecting and analyzing ... 706
  liquefaction, manual ... 511
  rise and development ... 619
Gassy and tainted curds, U. S. D. A ... 296
Gastritis caused by fungus infested cornstalks ... 592
  parasitic, in calves ... 995
Gastropacha quercifolia affecting fruits ... 1057
  quercus, remedies ... 371
Gastrophilus equi, notes, Miss ... 272
  hæmorrhoidalis, notes ... 765
Geel-dikkop disease, treatment ... 593
Geese, breeding ... 673
  breeds ... 972
  spirillum disease ... 589
Gelatin, properties ... 706
Gelechia cerealella. (*See* Angoumois grain moth.)
  solanella, notes, U. S. D. A ... 472
Gelsemium sempervirens, internal phloëm ... 818
Generator for hydrogen sulphid ... 214
Genista tinctoria affected by *Macrobasis unicolor*, Conn. State ... 702
Geographical Congress, Seventh International, U. S. D. A ... 819
Geometridæ, effect of mild winter on first flight ... 658
Georgia Station, financial statement ... 396
Georgia Station, notes ... [illegible]
Geraniums, fertilizer experiments ... 458
  varieties, Can ... 644
German common school with a garden ... 799
Germination—
  apparatus for beet seed ... 56
  as affected by alkali, Utah ... 459
    Wyo ... 1052
    anesthetics ... 1056
    copper sulphate ... 361
    electricity ... 355, 462
    enzyms, Vt ... 354
    ferments ... 460
    liquid hydrogen ... 1053
    moisture ... 1056
    size of seed ... 159, 353
    temperature ... 54, 156, 356
  bed, effect on germination ... 460
  chemical processes ... 55
  increase in mineral matter during ... 1056
  of cereals ... 355
    oil bearing seed, changes in composition ... 55
    orchids ... 355
    seeds as affected by age ... 157
      notes ... 219
      requisite conditions ... 1055
      within the fruit ... 355
    wheat as affected by nutrient solutions ... 750
      respiration ... 29
  tests at home ... 857
    with seeds ... 856, 857
Gestation in cows, N. Y. Cornell ... 81
  U. S. D. A ... 599
Gibberella saubinetii, notes, Ohio ... 161
Ginger, analyses, Conn. State ... 769
  culture and manufacture ... 250, 744
Ginkgo biloba, characteristics of sexes ... 220
Ginseng, culture and marketing ... 547
  notes ... 240
Gladioli, varieties, Can ... 644
Gladiolus diseases, treatment, N. J ... 752
Glanders bacilli, analyses, U. S. D. A ... 996
  control in Russia ... 895
    on the steppes ... 895
  diagnosing with silver preparation of Credé ... 495
  diagnosis ... 1089, 1092
  differential diagnosis, U. S. D. A ... 985
  in Massachusetts ... 1087
  inoculation in camels ... 290
  mallein tests ... 896, 993
  natural recovery of horses ... 895
  notes ... 190, 285, 793, 794, 995
    Nebr ... 393
    U. S. D. A ... 995
  outbreak in Holland ... 495
    Russia ... 895
  reappearance of disease ... 1092
  sanitary regulations ... 895
  State control in Minnesota ... 1092
  transmission to man ... 288
    through conjunctiva ... 697
  treatment, N. Dak ... 889
Glœosporium ampelophagum, notes ... 59, 260

Page.

- *Glœosporium juglandis*, notes, Mass. Hatch. 552
  - *nervisequum* affecting sycamores 759
    - notes, Mass. Hatch 552
  - *olivarum*, notes 949
  - *ribis*, notes 167
  - *salicis* affecting willows 1061
  - sp. affecting red clover, Mich 59
    - notes 861
- Gloxinias affected by Anguillula 1061
- Glucose by-products, analyses, Mo 1076
  - determination 22
  - value in arsenical insecticides 560
- Glucosid, new 706
  - of millet, N. Dak 214
- Glucosids, decomposition by fungi 322
  - in Spiræa 715
- Gluten feed, analyses, Conn. State 279
    - Me 971
    - N. J 777
  - Buffalo, analyses, Me 279, 971
  - Chicago, analyses, Conn. State 777
  - description 971
  - diamond, analyses, Me 971
  - Peoria, digestibility, Mass. Hatch 566
  - Rockford diamond, analyses, Me 279
  - meal, analyses 381
    - Conn. State 279
    - N. J 777
    - Chicago, analyses, Conn. Storrs 882
      - Me 279, 971
    - cream, analyses, Me 279
    - for cows 885, 888
    - King, analyses, Me 279, 971
  - refuse, analyses 971
- Glutin, properties 706
- *Glyceria aquatica*, poisonous to cattle 796
- Glycerids, distribution of enzyms 125
  - of butter fat 615
- Glycerin for milk fever 696
- Glycogen, determination 22, 419
  - formation from leucin 576
    - without glycogen 1076
  - transformation from fat 184
- *Gnathostoma hispidum*, notes 697
- Gnats, notes 263
- Gnetum, studies 121
- Goats as milk-producing animals 587
  - bots in head 191
  - disease resembling tuberculosis 797
  - distribution of galactase in milk, Wis 580
  - epizootic pneumonia, notes 805
  - foot-and-mouth disease 695
  - gangrenous mammitis 191
  - growth as affected by composition of milk 576
  - in the United States, U. S. D. A 483
  - lung-worm disease 191
  - tuberculosis 193
- *Goës tigrina*, notes 168
- Golden-rod, notes, Vt 354
- Goniocotes, notes 263

Page.

- Goniodes, notes 263
- Gooseberries, analyses 1046
  - culture experiments, N. J 735
  - fertilizer experiments 1039
    - N. J 735
  - grafting on currants 850
  - irrigation 1039
    - experiments, N. J 735
  - notes, Mont 251
  - preservatives for exhibition purposes, Can 649
  - varieties 251, 650
    - Can 547, 644, 844
    - Mich 153, 252
    - Pa 452
    - Wis 150
- Gooseberry leaf spot, notes 861
  - mildew, notes 861
    - treatment, N. Y. State 945
  - pectin 906
- Gophers, remedies 429, 659
- Gorse for sheep 773
- *Gortyna nitela*, notes, Conn. State 762
- Gossypol in cotton seed 510
- Gradients, vertical, of temperature, U.S.D.A. 222
- Graft, Cadillac 548
- Grafting chestnuts, Conn. State 742
  - cleft, fruit trees in fall 451
  - effect on plant nutrition 344
  - grapevines, new method 52
  - in creation of varieties 250
  - modifications induced 152
  - monocotyledons 910
  - muskmelons 153
  - sugar beets 334
  - transmission of acquired characters 343
- Grafts, whole vs. piece root for apples 548
- Grain aphis, natural enemies, Mont 266
  - notes 955
    - Can 862
    - N. Dak 264
  - remedies 175, 959
- Grain crops of the world for 1899, U. S. D. A. 698
  - damaged, analyses, Mass. Hatch 138
  - drilling, advantages 145
  - hulls, analyses, Me 971
  - lodging 44, 145
  - preparation of seed bed for, Can 642
  - rusts in Austria, notes 468
  - stored, insects affecting, Okla 1066
  - vs. blood-molasses for pigs 69
  - weevils, remedies 366
  - winter, condition in April, 1898, U. S. D. A 397
- Grains, tillering, U. S. D. A 599
- Grama grass causing disease in horses, Okla. 1090
- Gramineæ, development of seed coat and pericarp 220
- "Gran Cultura" in Porto Rico, U. S. D. A 819
- Granary weevil, notes 955
- Grape anthracnose, notes 260, 261
    - Tex 248
    - treatment 59, 861
- Grape berry moth, notes, Tex 248
  - remedies 367

Page.

- Grape bitter rot, notes 260
  - black rot, fungus parasite 357
    - notes 167, 260, 469
      - Tex 248
    - occurrence on leaves as related to that on fruit 758
    - preservation and reproduction 358
    - prevention 166
    - recent investigations 758
    - relative efficiency of fungicides 862
    - rôle of *Phoma reniformis* 1061
    - treatment 262, 358, 362, 758, 759
  - Botrytis disease, notes 260
  - cane borer, notes, U. S. D. A 366
  - culture in Russia 154
  - cuttings, packing for shipping in warm climates 549
  - disease, California, in Sorrento 59
  - diseases, classification 58
    - in Brazil, notes 59
  - downy mildew affecting fruits 1057
    - notes 59, 516
    - treatment 256, 469, 556
  - growing in France as affected by light freezes 31
    - New York and Ohio 937
  - industry in California, U. S. D. A 452
  - leaf blight, notes, Tex 248
    - diseases, notes 861
    - folder, notes, Tex 248
    - hopper, notes, Tex 248
  - lees and marc as fertilizers 138
  - mildew, notes 59, 260
    - Ky 170
    - treatment 167, 362, 947
  - new micromycete 261
  - Peronospora, treatment 362
  - powdery mildew, notes 260
  - root rot, notes 59, 260
    - Tex 248
  - roots, aerial 28
    - as affected by phylloxera 262
  - sooty mold, notes 260
    - rot in Sorrento 59
- Grapes, American, culture 52
  - Amur 745
  - as affected by bees, Mich 60
    - unusual cold, Ala. College 1041
  - attacked by *Cuscuta monogyna* 159
  - bacterial disease 59
  - blanching, notes 58
  - blossoming season, N. Y State 249
  - bud development 851
  - coloring 452
  - culture 253
    - effect on alcohol content of wine 648
    - on sandy soils 745
  - development as affected by environment 52
  - disinfection of stock against phylloxera 959
  - distances for planting 937
- Grapes, dropping, causes [illegible]
  - fertilizer experiments 150, 545
  - forcing 745
  - fruit development as affected by seed development 933
  - fungus diseases 362
  - grafting by Cadillac method 548
    - on peaches 850
  - injury by wind 59
  - irrigation 745
  - manuring in France 549
  - native, fifty years' improvement 650
  - new method of watering 50
  - normal number of seeds 935
  - on sandy soils, fertilizers for 650
  - parasitic diseases 949
  - protection against spring frosts 650
  - replacing barnyard manure with commercial fertilizers 932
  - resistant varieties 482
  - ripening as affected by seed development 935
  - sacking, Mo 349
  - seedless, notes 320
    - origin 934
  - self fertility 458
    - N. Y. State 248
  - sterility, N. Y. State 249
  - shanking, notes 58
  - shelling, notes 58
  - subirrigation by brush ditches 452
  - sulphuring 168
  - varieties 251
    - Can 547, 644, 844
    - Mass. Hatch 544
    - Mich 153, 252
    - Miss 253
    - Mo 349
    - Okla 929, 1036
    - Tex 248
    - Va 932
- Grapevine borer, remedies 273
  - flea-beetle, notes 370
    - remedies, N. Y. State 64
  - mildew, treatment 165
  - Psychid caterpillar 1063
- Grapevines as affected by lightning 52, 122
  - fungus diseases 758
  - girdling, U. S. D. A 599
  - new method of grafting 52
  - ringing, N. Y. State 49
  - training 52
- *Grapholitha prunivora*, notes, Can 863
- Grass and clover mixtures for resowing winter-killed fields 44
  - insects, remedies 1064
  - lands, liming, R. I 642
    - seeding with vs. without nurse crop, N. H 140
    - top-dressing, N. H 145
  - mite, remedies 174
  - mixtures for permanent meadows, Can 632
  - roots affected by crane flies 1066
  - seeds, fungus parasites 166
    - impurities, U. S. D. A 468

Page.

- Grass seeds, weed seed in 1054
  - thrips, remedies, Mass. Hatch 561
  - tick, remedies 891
  - utilisation of nitrogen in different forms, Conn. State 722
- Grasses, agricultural, of Kansas 420
  - American, notes, U. S. D. A. 219
  - and clovers of different regions, comparison 156
  - as affected by nitrogenous fertilizers 539, 835, 836
  - cooperative experiments, U. S. D A 1032, 1033
  - culture experiments, Colo 339
    - S. Dak 43
  - destruction on cattle ranges, U. S. D. A 220
  - fertilizer experiments .. 140, 230, 332, 838, 1027, 1028, 1037
    - Del 141
    - Mass. Hatch. 530
    - R I 641
  - for hay, Ala. College 145
    - lawns, N. J 743
    - moor soils of Germany 43
    - pastures, Ala College 145
    - the South, notes 241
  - grazing, of western Kansas 498
  - liming experiments, N. H 136
  - new, from the Southern States 1037
    - species, U. S. D. A 28
  - notes, Can 833
    - La 28
    - N. Dak 339
    - Nebr 315
    - Tenn 927
    - Va 120
  - of Iowa, ecology 709
    - Nebraska, South Dakota and Wyoming, notes 319
    - Northwest Canada, analyses of hay, Can 873
    - Oklahoma 1015
  - sand binding, U S D. A 423, 1034
  - structure of caryopsis, U S D. A 423
  - syllabus of instruction 1099
  - tests of species 818
  - varieties, Can 631, 632
- Grasshopper disease, South American, notes, Nebr 370
- Grasshoppers, native, notes, Colo 370
  - notes, Minn 864
  - of Nebraska, notes 370
  - predaceous and parasitic enemies 265
  - remedies 265, 565
- Gravitation, effect on movements of ground water 517
- Gray field slug, notes 371
- Great Lakes, level as affected by precipation, U. S D. A 622
  - meterological charts, U. S. D. A 621, 912
  - storm signals, U. S. D. A 127
  - water temperatures. U.S.D.A 620
  - weather forecasts as related to maritime interests, U. S. D. A 126
- Greenhouse aphis, remedies, Ohio 473
  - benches for subwatering 50
  - plants as affected by algæ 906
    - insects affecting 765
- Greenhouses, disinfecting, Mass. Hatch 552
  - heating by steam at low pressure 155
  - hygrometers in 937
  - inexpensive forms 937
  - management 937
- Greening of oysters 426
- Green manuring, crops for 442, 534, 917
    - Ariz 254, 833
  - of vineyards 452
  - utilization of cover crops 538
  - value 538
  - with autumn catch crops 829
- Green scale, fungus disease 275
- Ground bone, analyses, Mass. Hatch 138, 528
    - N. J 830
  - for calves 80
  - corn, analyses 381
    - and oats, analyses, Me 279
  - fish, analyses, N. J 830
  - fleas, remedies 174
  - oat hulls, analyses, Me 971
  - oats, analyses 381
  - phosphate, analyses, La 39
  - shrimp refuse, analyses, La 39
  - water, depth of penetration 517
    - movements as affected by different factors 517
    - surface, configuration 517
      - elevation as affected by precipitation and percolation 517
  - waters, theoretical flow 519
- Growing season in 1898, duration, U. S. D. A. 430
- Growth characteristics, transmission 910
- Grubs, white, in meadows 957
  - notes 174
- Guanin in cane juice 310
- Guano, Damaraland, analyses, Ky 314
- Guanos and nitrogenous superphosphates, analyses, Conn. State 719
- Guernsey cattle, notes, U. S. D. A 983
- Guinea grass, feeding value 482
  - pig, septicæmia 291
  - pigs, growth as affected by composition of milk 576
- Gum, forest red, notes 1052
- Gumbo soils, water-soluble matter in, N. Dak 224
- Gums, analysis methods, handbook 1008
- *Gymnetron teter*, notes, U. S. D. A 952
- Gypsy moth, destruction by birds, U. S. D. A 953
  - diseased larvæ 1063
  - extermination in Massachusetts 559
  - extermination in Massachusetts. U. S. D. A 954

Page.

Hadena devastatrix, notes, U. S. D. A 952
  secalis, notes 765
Hæmatobia serrata, notes, Can 864
  Miss 272
Hæmatopinus, notes 268
Hæmosporidia, life history 658
Hail, protection against 1018
  storms, prevention by explosions .. 328, 821
Halo, solar, U. S. D. A 222
Halogen compounds, physiological rôle, U. S. D. A 1008
Halteridium, life history 658
Halterophora capitata, notes 273, 558, 563, 870, 1065
Haltica chalybea, notes, N. Y. State 64
  U. S. D. A 952
Halticus uhleri, notes, U. S. D. A 364, 471
Hams, curing, N. C 497
Hamster in Belgium 371
Handmaid moth, notes 272
Hardhack, notes, Vt 354
Hard-wood ashes, analyses, Minn 831
Haricot, etymology 250
Harlequin cabbage bug, notes 955
Harpiphorus maculatus, notes, Mich 954
Harrows, draft, Mich 96
Harvest mite, remedies 174
Haskell oat feed, analyses, Me 279
Hawaiian eruptions, U. S. D. A 429
  Islands, agricultural conditions, U. S. D. A 497
Hay, analyses, Mo 971
  crops, fertilizer experiments 230
  digestibility, Mass. Hatch 566
  effect of different fertilizers on feeding value 1072
  feeding value 576
    as affected by fermentation 479
  fine rowen, analyses, Conn. Storrs 882
    digestibility, Conn. Storrs 874
  irrigation experiments, Wis 537
  mixed, analyses, Conn. Storrs 882
    N. J 777
  moldy, poisoning cattle 796
  nutritive value 73
  of Norwegian fodder plants, analyses 79
  second quality, analyses, Conn. Storrs 882
  spontaneous combustion, U. S. D. A 599
Haymaking methods 242
Hazelnut oil, composition 619
Hazel trees, destruction by *Lecanium corni* 371
Health boards, State, secretaries, U. S. D. A 998
Hearing in bees 172
Heart diseases, text-book 1090
  water, treatment 993
Heat, animal, chemistry 482
  effect of diminution on cocoons of silkworm 65
    on stomata 115
  evolution of moistened soils, determination 1022
  exchange in the soil 132
  radiant, and frost prevention, U. S. D. A 429
Heat radiation between earth and atmosphere 132
  of stars, U. S. D. A 819
Heating, artificial, as affected by atmospheric moisture, U. S. D. A 127
  power of different woods 854
Hedges, notes 353
Helianthus tuberosus, notes 649
Heliothis armigera. (*See* Bollworm.)
  rhexia, remedies, U. S. D. A 471
Hellebore, preparation and use, Mass. Hatch 174
Helleborus, classification 852
Hellula undalis, notes, Ga 368
  U. S. D. A 364
Helminthiasis nodularis affecting cattle 91
Helopeltis antonii, notes 273
Hemaglobinemia of sheep, treatment 895
Hematuria of cattle, notes 894
Hemerocallis affected with Asteroma 261
Hemiberlesia, North American species 657
Hemichionaspis, monograph 563
Hemileia vastatrix affecting coffee 1065
  on coffee, treatment 1060
Hemiptera, notes 370
Hemp, culture in Russia 443
  investigations 44
  Manila, production in the Philippines 733
  seed, viability 158
  sisal, culture 443
    in Mexico 733
  water absorption of seed 1056
Hen manure, analyses, Mass. Hatch 1026
Hens, number profitably kept in one pen, Me 969
  vs. pullets for egg production, Utah 480
Herbarium specimens for exchange, N. C 909
Herd record, Mich 86
Hernia, diaphragmatic, in horses 191
Hessian fly as affected by meteorological conditions 1009, 1100
  life habits, Ohio 476
  notes 558, 564, 766, 955
    Can 862
    Mich 954
    Minn 864
    N. Dak 264
    U. S. D. A 952
  remedies 175, 658, 959
Heterodera radicicola, notes 259, 711
  Ga 173
  schachtii, notes 259, 429, 712
    remedies 959
Heterœcious rusts, culture experiments 59
Hibbertia bennetti, notes 220
Hibiscus diseases, treatment, N. J 752
Hickory borer, notes, U. S. D. A 366
  painted, remedies, Ohio 63
High schools and the Weather Review, U. S. D. A 819
Highways in Maryland 798
Hippodamia convergens, notes, U. S. D. A .. 470
Histidin, occurrence in germinating seeds . 1056
Histogenesis of the tubercle of tuberculosis 93

Page.

H. O. feeds, analyses, Conn. State, 279, 777
    Me, 279, 971
    N. J, 777
  digestibility, Mass. Hatch, 566
    Me, 965
  for cows, 985
Hog cholera and swine plague, distinguishing, 696
  bacillus as affected by heat and chemical antiseptics, 797
    description, 492
    nonmotile, 93
    retention of virulence in milk, U. S. D. A., 980
  differential diagnosis, U. S. D. A, 985
  duration of induced immunity, 594
  eradication in Austria, 797
  experiments, 93
  germ, enzyms, U. S. D. A, 997
  germicide, Minn, 812
  immunization, U. S. D. A, 997
  in Iowa, U. S. D. A, 997
    Norway, 693
  local outbreak, Mich, 1086
  notes, 190, 290, 995
    Nebr, 393
    U. S. D. A, 995
  Pasteur prophylactic inoculations, 594
  preventive inoculation, 793, 797, 892
  serum for immunization, 495
    treatment, U. S. D. A, 89
  studies, 191
  transmission by insects, 995
    to man, 288, 895
  treatment, 696, 895
    U. S D. A, 997
Hollyhock diseases, treament, N. J, 752
Hollyhocks, culture, 352
Holstein cattle, notes, U. S. D. A, 983
Hominy chop, description, 971
  feed, description, 971
  meal, digestibility, Mass. Hatch, 566
    vs. corn meal for pigs, Mass. Hatch, 568
Honey, analyses, Conn. State, 769
  and pollen-producing plants of Kansas, 266
  bearing plants of agricultural importance, 561
    the maritime Alps, 1064
  comb, foundation experiments, 271, 557, 658
    management, 172
    production, 271
  feeding back, Mich, 61
    Vt, 370
  from different plants, analyses, 266
  methods of analysis, 813
  plants, poisonous, 271
  production, increase, 475
  quality as related to specific gravity, 653
Honeydew, notes, 271
Honeysuckles as ornamental shrubs, 550
Hoof meal and cracklings, analyses, N. J, 830

Page.

Hop culture in Bohemia, U. S. D. A, 725
  dogs, notes, 870
Hoplocampa testudinea, notes, 765
Hops, analyses, Idaho, 314
  culture experiments, 230
  determination of bitter principles, 22
  diseases, 167, 556
  fertilizer experiments, 230, 783
  insects and snails affecting, 476
  irrigation, 145
  liming, 145
  manual, 539
  manuring, 340
  studies, 1048
Hordeum cæspitosum, n. sp., notes, 319
Hormomyia fagi as cause of galls, 562
Horn fly, notes, Miss, 272
  remedies, Can, 864
  worms, tobacco, remedies, U. S. D. A, 471
Horse, Anglo-Norman, 779
  beans, culture experiments, Can, 833
  botfly, notes, 268
    Miss, 272
  chestnuts, spraying for *Phyllosticta sphæropsoidea*, N. J, 753
  diseases, manual, 93
  nettle, eradication, Wis, 749
    notes, Iowa, 651
      Okla, 354
  radish, core rot, notes, 362
    culture in Bohemia, U. S. D. A, 1047
    white rust, 758
Horseflesh in sausage, detection, 21
Horses, American, in foreign countries, 75
  Borna disease, 588
  breeding, 673
    for the German military service, U. S. D. A, 972
  care, 184
  colic, 394
    remedies, 191
  diaphragmatic hernia, 191
  effect of sex on susceptibility to disease, 896
  epizootic pleuro-pneumonia, notes, 896
  feeding experiments, 74, 80, 880
    Okla, 1069
    Va, 183
    in Argentina, 577
  importation into Great Britain, U. S. D. A, 999
  iritis in, notes, 896
  lead poisoning, 191
  malarial fever, 290
  management, 972
  metabolism experiments, 72
  native Russian races, 779
  natural recovery from glanders, 895
  of Hungary, 381
  silage for, U S. D. A, 599
  tuberculin test, 795
  tuberculosis, 393
  working, feeding, 673
  worm diseases, 191
Horseshoes, nailless, 291

Page.
Horseweed, notes, Okla 354
Horticultural experiment stations 198
periodicals, indexes 650
Horticulture and agriculture, school of applied 900
in Belgium 351
Russia 744
nomenclature 851
notes, U. S. D. A 397
Hotbeds, construction, Idaho 351
Hot water for grape mildew 165, 947
phylloxera 959
treatment for oat smut, R. I 944
use of different temperatures 478
House fly, notes 263
wren, notes 428
Hubl's reagent, preservation 510
Human flea, notes 263
Humates and soil fertility 228
percentage in soils, N. Dak 224
Humic acid method for phosphates 1004
Humidity, vertical gradients, U. S. D. A 621
Humus and soil fertility 1099
content of soils, N. Dak 224
as affected by lime 824
decomposition of mineral salts 623
different forms in agriculture 916
in soil, determination 110
studies 1022
Hungarian hay, analyses, Conn. Storrs 882
Hurricane at St. Kitts, U. S. D. A 621
service of West Indies, U. S. D. A 126
tracks in the North Atlantic, recurving, U. S. D. A 819
Hurricanes, notes, U. S. D. A 432
Hyblæa puera, notes 1063
Hybrid coffee, notes 240. 449, 452
orchid, new 549
orchids 52
plums 352
Vt 47
Hybridity, evidences, Vt 47
Hybridization, essays 152
limits among orchids 52
notes 1016
principles 453
Hybrids, classification, Vt 48
disordinate variation 27
spontaneous, in European flora 120
of hardy plants 249
Hydrocyanic-acid gas—
as an insecticide, Cal 64
effect on low-growing plants 1100
plants 1009
for scale insects of the orange 372
handling in orchards, U. S. D. A 951
Hydrocyanic acid in seeds of Vicia 748
occurrence in plants 121, 320
solution, determination of iron 213
Hydrœcia, revision of genus 371
Hydrogen, determination in nitrogenous organic substances 811
peroxid, chemical dynamics 706

Page.
Hydrogen, peroxid, for determination of formaldehyde 419
sulphid, generator 214
Hydrology of Lake Minnetonka watershed, U. S. D. A 221
Hydrolysis of cellulose by acids 20
Hydrometer, Baumé's, American standard 22
Hydrotherapy for domestic animals 495
Hygiene, handbook 1007
in relation to manures 82
of cattle 592
Hygrometers for dairies, Can 689
in greenhouses 937
Hygrometric observations, U. S. D. A 127
Hygroscope for determining the opening and closing of stomata 114
Hylastes trifolii, injuries by 564
Hylesinus crenatus, notes 477
fraxini, notes 474, 476
oleiperda, notes 474, 476
porcatus, notes 173
Hymenoptera, Norwegian 66
notes 370
Hyphantria cunea, notes, N. H 169
Hypocotyls in woody plants 28
Hypoderma bovis, notes 272
Miss 272
Hypodermic injection, improved needle 896
Hyponomeuta malinella on apple trees 564
Hyposulphite for determination of oxygen in water 312
Hysterium pinastri notes 1061
Ice, breaking up at Pierre, S. Dak., U. S. D. A 222
business and Weather Bureau, U. S. D. A 222
jam in Niagara River, U. S. D. A 222
measurements, U. S. D. A 127
vapor pressure for, U. S. D. A 819
water, analyses, Vt 328
Icerya purchasi, notes 477, 959
Ichneumon fly, notes 168
Icteroid bacillus 192
Idaho Station, notes 173, 398, 800
University, notes 800
Illinois Station, financial statement 396
notes 199, 297, 1097
University, notes 1097
Illumination, effect on stomata 115
Immunity as affected by injections of blood from other species 892
related to lymphatic system 90
studies 390
Immunization, excessive, loss of bactericide action 292
Incandescent lamps in ether extraction 420
India rubber, preparation for market 515
Indian callalu, analyses 249
Indiana Station, circular 898
financial statement 396
notes 199
Indicator, new 214, 814
Indicators in alkalimetry 810
use and preparation 619

Page.
Indigestion caused by fungus-infested cornstalks 592
Indigo dye vats, refuse from, analyses, R. I. 917
    insects affecting 1063
    natural and artificial 112
    refuse as a fertiliser 144
Individualism of plants 249
Indol, formation and combustion 576
Industrial chemistry, dictionary 618
Infants, "germ free" milk for 889
    milk from one cow vs. mixed milk for, Ohio 692
Infection as related to lymphatic system 90
Influenza, inoculation experiments 288
Infusoria in stomachs of ruminants 91, 896
Ink cap, notes, N. Y. Cornell 322
Inoculation for influenza 288
    Texas fever, Okla 391
    in utero 594
    preventive 291, 393, 893
Insecticide and fungicide, new 60
    pumps, tests 172
    tests, notes, Colo 370
Insecticides—
    adhesive 478
    analyses, Minn 812
    arsenical, adulteration 1100
    effect, N. Y. State 172
    notes 1064
        Okla 1067
    preparation and use 174, 175, 262, 478, 558, 565, 765, 955, 959
        Ill 258
        Iowa 958
        Mass. Hatch 174
        Mich 274, 955
        N. C 659
        R. I 262
    spring application 1100
Insects, advantages of inspection laws 959
    affecting shade trees 370
    and the pollination of plums, Vt 348
    beneficial 370
    collection and preservation 172, 272
    color as affected by environment 870
    combating 67
        by natural enemies 959
    distribution in Ohio 272
    economic status 168
    efficiency of quarantine regulations, U. S. D. A 950
    estimates of depredations 370
    injurious, index to Miss Ormerod's report 765
        in Sweden 66
        natural enemies in India 1063
        notes 957, 1100
        of Maine 956
        remedies 372
    manual 272
    methods of collecting and rearing, U. S. D. A 951
    migration between Germany and United States 764
    molting, as means of defense 172
    of 1900 in Ohio 1100

Page.
Insects, parasites, economic value 1160
    studies of wings 562
    temperature 556
    transmission of diseases by 561, 693, 995
    underground, new method of studying 562
    wood boring of fruit trees 178
International date, U. S. D. A 221
    Electrical Congress, U. S. D. A 621
    Meteorological Committee, U. S. D. A 222, 621
Intestine, large, of dogs, effect of removal 276
Intravenous injections, advantages 892
Inulin, occurrence and nature 217
Iodid of potash for actinomycosis 193
    parturient apoplexy 192
Iodin content of air 133
    number, fatty acids 813
    value, determination 705
Iodoform, antiseptic power 496
Iola lasioboli, n. sp., notes 361
Iowa College, notes 199, 297
    Station, notes 199, 297
Iris bulb, fungus disease 360
Iron compounds, physiological rôle, U. S. D. A 1008
    determination in hydrochloric acid solution 213
        organic substances 813
        presence of alumina 613
        water 23
    sulphate and lime for anthracnose of grapes 59
        for charlock 461
Irrigating canals, State 197
    gardens 547
Irrigation and Congress 195
    drainage 826
    sociology 195
    by artesian water 798, 1094
        wire, U. S. D. A 620, 819
    canals, building 195
    cession of arid lands 195
    congress, proceedings 195
    excessive, U. S. D. A 599
    experiments with windmills 196
    for alfalfa 240
        asparagus, N. J 735, 1039
        blackberries, N. J 735, 1039
        bush Lima beans, N. J 738
        corn, Wis 538
        currants, N. J 735, 1039
        gooseberries 735, 1039
        grapes 745
        hay, Wis 537
        hops 145
        orchard fruits 1039
        potatoes, Wis 538
        raspberries 735, 1039
        strawberries 736, 1039
        tomatoes, N. J 738
    in California 395
        Colorado 294
        fruit growing 1048

Page.
Irrigation in market gardening 294
New Mexico 93
San Joaquin Valley 196
South Dakota 97
the Rocky Mountain States, U. S. D. A 1093
Wyoming 294
Yakima Valley 395
investigations, U. S. D. A 397
of grapes 449
meadows 734
orchards in winter, Ariz 847
pumping water for 1094
reservoirs on the plains 597
scheme for the Hartz River Valley 798
sewage 1093
systems in Texas 94
water, conservation, Wyo 1026
form for weekly record of use, U. S. D. A 798
sediment content 622
work of the agricultural experiment stations 195
works, extent of injuries by sheep 748
on Vaal River 598
unprofitable 294
Isomaltose, studies 511
Isosoma tritici, notes 558
Ithycerus noveboracensis, notes, U. S. D. A. 952
Ixodes hexagonus, notes 593
plumbeus, notes 593
reduvius, notes 593, 891
ricinus, notes, La 588
Va 173
Jadoo fiber, analyses, Conn. State 719
Mass. Hatch 528
Jams, analyses, Conn. State 769
Japanese medlar. (*See* Loquat.)
persimmons, notes, Tenn 148
pines, wart disease 460, 861
plums, shot-hole effect, N. Y. Cornell 165
varieties, Mich 50
redbud diseases, treatment, N. J. 752
Jassidæ affecting grasses, unsolved problems 766
Jellies, analyses, Conn. State 769
Jersey cattle, management 489
notes, U. S. D. A 983
types 688
Jerusalem artichoke 649
artichokes for pigs, U. S. D. A ... 296
Johnson grass, notes, U. S. D. A 423
Jointworm, notes 955
Can 862
Jonquils, source of odor 1100
Jowari affected by *Leucania unipuncta* 1062
Juglans cineria, notes 549
cordiformis, notes 549
nigra, notes 549
regia, notes 549
sieboldi, notes 549
Julus guttulatus, notes 273
Juniperus communis, gall formations 562

Page.
Juniperus phœnicea, bacterial excrescences . 167
Kafir corn, feeding value 1076
fodder, ash analyses, Okla 377
for domestic animals, Okla 1069
pigs, Kans 496
notes, Mich 1087
products, nomenclature 1076
varieties, Mich 43
Okla 1036
Kainit, analyses, Conn. State 719
Ky 314
La 39
Mass. Hatch 528
N. J 330
Tex 438
as a preservative of barnyard manure 329
effect on wireworms, Ohio 472
for grapes 150
Kakis, notes 252
Kale, dwarf German, analyses, Minn 383
notes, Vt 354
varieties, Can 632
Mich 250
Kalmia angustifolia, notes 271
Kansas College, notes 1097
Station, financial statement 897
notes 199, 297, 699, 1097
Kei apple, notes 454
Kentucky blue grass, notes, Ala. College .. 154
Station, financial statement 396
Keratitis, contagious, treatment 1091
notes, Nebr 393
Kero water machine, description, N. Y. State 172
Kerosene as an insecticide 66
Me 262
emulsion, preparation and use ... 273, 371, 957
emulsion, preparation and use, Mass. Hatch 174
for San José scale, Conn. State ... 762
Del 473, 474
Ill 654
N. J 760
water, preparation and use, Mass. Hatch 174
Kidney bean, Chevrier, management 744
Kinematics of machinery, manual 798
King birds, notes 271
"Kissing bugs" and spider bites 561
Kite meteorograph, construction and operation 821
observations by the Weather Bureau in 1898, U. S. D. A 621
records in New Jersey, U. S. D. A 430
Kites and meteorological research, U.S.D.A. 432
spool, U. S. D. A 429
Kohl-rabi, fertilizer experiments 646, 842, 851
varieties 842
Can 631
Mich 250
Kola as a food protector 970
effect on muscular work 79
nuts, analyses 249
Kraal manures, analyses 596

Page.
Kuhnke milk filter........................ 284
"Kuro Siwo," effect on temperature of Pacific Northwest........................ 622
Laboratories, State analytical 619
Laboratory air, effect on nitrobacteria..... 125
  methods and apparatus, new, N. J.......................... 714
Lachnosterna arcuata, notes, U. S. D. A 365
Lachnosterna, parasite.................. 265
Lachnus abieticola, notes.................. 657
  maculosis, notes.................. 657
  persicæ, notes.................. 657
  piceæ, notes.................. 562, 657
  pyri, notes.................. 957
  rosæ, notes.................. 657
Lacmoid as an indicator.................. 311
Lactic-acid bacteria, function in ripening cheese............ 787
  in ensiled beet chips. 714
  determination.................. 1006
  ferments of albuminoid decomposition in Emmenthaler cheese.................. 981
Lactuca scariola, poisonous to stock 1057
Ladybird, northern.................. 272
Ladybirds destroying *Icerya purchasi*..... 477
Lake level, sudden oscillations, U. S. D. A. 620
Lakeside corn-and-oat feed, analyses, Me.. 279
Lambs, Cleveland flax meal vs. linseed meal for, Mass. Hatch 566
  farm grains for, before and after weaning, Wis.................. 567
  fattening in winter, Conn. Storrs 877
  feeding experiments, Can 666
    Colo 379
    Minn........ 179
    Okla 1069
Laminitis, acute, treatment................ 394
Lampronia rubiella, notes 264
Land, fall plowing, as affected by frost 44
Land-grant colleges and the national defense, U. S. D. A... 98
  statistics, U. S. D. A 397
Land leveler, test, Mont.................. 1037
Lands, impoverished, treatment, N. Y. Cornell.................. 1022
Landsberg serum for hog cholera.......... 895
Landscape gardening 852, 853
  for rural school grounds, N. Y. Cornell.................. 50
  N. Y. Cornell........ 49
Langstroth beehive, description 172
Lantana bug, remedies.................. 564
Lantern trap, use.................. 174
Larch, European, notes, Can 855
  leaves, browning.................. 556, 1061
  sawfly, notes, Can.................. 657
  woods of Scotland.................. 942
Lard; detection of cotton-seed oil 811
Larix europæa, notes, Can.................. 855
Larkspur poisoning, notes, Nebr 315
L'Armagnac, agricultural conditions 497
Lasioderma serricorne, notes 871
  U. S. D. A... 472
Lathridiidæ, monograph 562, 871
Lathyrus sylvestris. (*See* Flat pea.)
Latitude, effect on development of corn.... 120
  germination of wheat... 355
Latrodectus mactans notes 561
"Laurel green," analyses, Ky 314
Laverania danylewsky, notes.............. 291
Laverna gleditschiella, notes, U. S. D. A .. 952
  herellera, notes 558
Lawn grass mixtures, tests.............. 745
  grasses, culture experiments, N. J.. 743
    for Alabama, Ala. College .. 154
Lawns, establishment, Ala. College........ 154
  fertilizers for, Wis.................. 528
  management 353
  wood ashes for, Mich 1047
Laws for acquiring titles to water in the Missouri watershed, U. S. D. A 96
Lead poisoning in horses 191
Leaf-bug, four-lined, remedies, Can........ 863
Leaf curl, treatment, Mich.................. 252
  mining fly of French beans 563
  rusts, distribution, U. S. D. A.......... 943
Leather refuse, effect on growing rye in presence of phosphates, Mass. Hatch..... 526
Leaves, aldehyde content 710
  and their uses.................. 910
  as affected by electric light........ 708
  dry forest, analyses of water extract, Mass. Hatch 138
  fixation of carbon.................. 1015
  green coloration as related to chlorophyll assimilation.................. 513
  mucilaginous epiderm 116
  photosynthesis, effect of light transmitted 1010
Lecanium affecting citrus fruits............ 657
Lecanium corni, affecting hazel trees 371
  nigrofasciatum, notes, U. S. D. A 952
  oleæ, notes 474
  persicæ, remedies.................. 958
  sp., notes, Can.................. 657
  spp., notes, Iowa 958
  tulipiferæ, notes, N. J 762
  viride, extermination.............. 871
    notes.................. 275, 959
Lecithin, effect on anthrax bacillus 898
  biology of splenic fever bacillus 92
  formation and transformation 217
  preparation from egg yolks 510
Legumes, bacteria of tubercles 218
  fertilizer experiments............ 234
    requirements 250
  for maintaining soil fertility 1036
  nitrogen assimilation as affected by removal of flowers......... 516
  parasitic nature of bacteria of root tubercles 25, 711
  root tubercles 25
  turning under stubble vs. whole plant, Ark.................. 921
Leguminous crops, experiments, Ala. Canebrake.................. 240
  plants, notes, Tenn............ 927
Lelong's nurse root process.................. 846
Lema, estivation 656
Lemon flavoring extracts, analyses 873

Page.
Lemon sooty mold, U. S. D. A 468
Lemons, curing 154
pruning 1047
Lepidoptera affecting tea 1062
migration 1064
new, from Africa 66
notes 370
Leptoglossus oppositus, notes, U. S. D. A 364
phyllopus, notes, U. S. D. A 364
"Leptomin" in sugar cane 146
Leptops hopeii, notes 558
Leptosphæria herpotrichoides, remedies 959
Leptothyrium pomi, notes 260
on American fruit 655
Lespedeza striata. (*See* Clover, Japan.)
Letter boxes for forecasts, U. S. D. A 222
Lettuce diseases as affected by subirrigation, Mass. Hatch 552
notes, Mich 58
drop, treatment, Mass. Hatch 552
fertilizer experiments 342
Mass. Hatch 543
forcing 1039
U. S. D. A 296
growth as affected by mechanical condition of soil, Mass. Hatch 552
head, fertilizer experiments 646
leaf blight, treatment, N. J 752
notes, Ariz 850
S. C 1047
rot, prevention, Ky 261
shading, N. J 739
susceptibility of different varieties to leaf blight, N. J 752
"top burn," Mass. Hatch 552
varieties, Mich 250
S. Dak 51
Leucania unipuncta affecting jowari 1062
notes, Ohio 62
Leucarctia acræa, notes, U. S D A 471
Leucin, formation of glycogen from 576
Leucocytes in milk 701, 785
relation to arsenical poisoning 91
Leucomains in urine, determination 23
Lice on animals, Kans 498
poultry, remedies 561
Lichens on plum trees, Vt 321
Licorice, culture 251
Ligaments, constituents 1100
Light, effect on butter 584
formation of plant proteids 707
fungi 321
growth of clover 815
stand of forest trees 458
sugar beets 443
for treatment of disease 1090
Lightning and the electricity of the air, U. S. D. A 322
ball, U. S. D. A 429
danger from, U. S. D. A 819
effect on grapevines 52, 122
trees 1051, 1052
losses by, U. S. D. A 621, 819
ribbon, U. S. D. A 430
serpentine, U. S. D. A 819
various kinds, U. S. D. A 620
Lignin, occurrence in vascular [illegible] gams [illegible]
Lignoceric acid, notes [illegible]
Lilies, notes, Vt [illegible]
Lilium, revision of genus 221
Vt [illegible]
Lima bean blight, Conn. State 757
mildew, Conn. State 754
pod spot, N. J 752
beans, bush, irrigation, N. J 738
mulching, N. J 738
thickness of sowing, N. J 738
varieties, N. J 738
fertilizer experiments, N. J 738
notes, S. C 1047
shading, N. J 739
Limax agrestis, notes 371
campestris, notes, U. S. D. A 472
Lime, analyses, Conn State 719
and Paris green for grapevine flea-beetle, N. Y. State 64
sulphur dip 191
as an insecticide 66
burnt, analyses, R. I 917
effect on different plants 1023
determination 106
dip, experiments 997
effect on humus content of soils 824
lupines 643
meadow grass, N. H 136
for chlorosis 469
hops 145
sugar beet root rot, N. Y. Cornell 163
beets, Wis 143
turnip club root 555
in soils of Hawaii, determination 507
uses in agriculture 230
Limekiln ashes, analyses, Conn. State 719
Mass Hatch 137
Limes, stunting of fruits 59
Limestone, analyses, Minn 812
N. Mex 1036
determination of carbon dioxid 508
Liming acid soils, R. I 915
cooperative experiments, R. I 918
experiments 1099
grass land, R. I 642
peas, N. J 739
tomatoes, N. J 739
Limodorum abortivum, chlorophyll assimilation 119
Linnet, green, notes, U. S. D. A 426
Linseed cake, analyses 971
nutritive value 73
vs. flax seed for cows 578
meal, analyses, Conn. State 279
Me 971
Cleveland, analyses 381
old process, analyses, Me [illegible]
N. J 777
vs. Cleveland flax meal for lambs, Mass. Hatch 566
oil meal, analyses, Minn 883
Lintner, J. A., life and entomologic work [illegible]
Lipeurus, notes [illegible]

Page.
Liquid air as a source of power, U. S. D. A.. 222
history and manufacture 511
fertiliser, analyses, Mass. Hatch.. 188, 528
hydrogen, effect on seed germination 1053
Lithium, distribution in plants 710
Lithocolletis *cincinnatiella*, notes, Mich 954
lucetiella, notes, Mich 954
Litter, peat vs. straw 438
Live stock associations of Ontario, report.. 778
commissioners of Illinois, report 285
farming as related to home making, U. S. D. A 397
feeding as related to farm fertility 971
in the South, U. S. D. A. 397
U. S. D. A 397
plants poisonous to, N. J. 113
U. S. D. A.. 909
reports for Manitoba 999
sanitary boards, State, U. S. D. A 998
statistics, Can 672
suggestions for quarantine laws 91
Liver fluke in the spleen of sheep 797
Locust, honey, thorns of, analyses, Mo 1008
leaf miner, notes 477
migratory, natural enemies 1066
notes, Minn 864
remedies 477
Rocky Mountain, notes 766, 957
Can 862
Minn 864
parasites, N. Dak 264
remedies, N. Dak. 264
spotted, remedies 477
Locusts, analyses 913
as a fertilizer 913
driving away with firearms 1063
insecticides for 1063
legislation in Paraguay 275
notes 760
remedies 366, 478, 659
Loganberry, culture 547
notes, Mass. Hatch 544
Mich 252
Wis 150
London purple, analyses 1100
preparation and use 273
Lone star tick, notes, La 588
Va 173
Longicorn beetle, parasites 174
Lonicera, varieties 550
Lophyrus pini, notes 272
rufus, notes 272
Loquat gummosis, notes 59
rot, notes 59
Loquats, breeding 252
culture 547
pruning 1047
Louisiana Stations, financial statement 295
"Louping ill" as related to the grass tick 593, 891
Louse-like insects affecting Brazilian plants. 476
Loxotænia rosana, notes 766
Lucern. (*See also* Alfalfa.)
experiments in seeding 441
web moth, notes 178
Luna moth, N. H 169
Lungs, bacterial flora 287
Lungworm disease, notes 995
of goats 191
prevention 894
Lupines, air-dry disembittered, nutritive value 73
analyses 44
as affected by lime 643
bacterial disease 861
fertilizing value at different stages of growth 917
for green manuring, Cal 534
poisonous to live stock 905
yellow, as affected by Nitragin .. 515
Lupinus albus as affected by acid sodium salts 1100
Lyctus striatus, notes 764
Lye, analyses, Idaho 314
Lygus pratensis, notes, U. S. D. A 952
Lymantria monacha, inoculation experiments 1064
parasites 1065
remedies 564
Lyme grass, sea, notes, U. S. D. A 423
yellow, notes, U. S. D. A 423
Lymexylon sericeum, notes 764
Lymphatic glands, reaction to micro-organisms 995
system as related to infection and immunity 90
Lyonetia clerckella affecting fruits 1057
Lysin, occurrence in germinating seeds ... 1056
Lysins, relation to agglutinins in anthrax. 494
Macaroni wheats in Australia, notes 481
Macrobasis unicolor affecting *Genista tinctoria*, Conn. State.... 762
remedies, U. S. D. A... 470
Macrodactylus subspinosus. (*See* Rose chafer.)
Macrosila cingulata, notes, Md 62
Macrozamia as a cause of rickets 1087
roots, effect on cattle 894
Macrozamia moorei, poisonous to stock.... 1057
spiralis, poisonous to cattle . 696
Magdalis ænescens, notes, Can 863
armicollis, remedies, Mich 954
Magiria robusta, life history 1066
Magnesia, analyses, Mass. Hatch 137
causing bitter taste in butter . 587
effect on different plants 1023
mixture for determining phosphoric acid 108
precipitating monosodium phosphate 108
preparation 109
Magnesium, determination of alumina in presence of 613
in ashes, determination 213
salts, physiological rôle, U. S. D. A 1008
Maine Station financial statement 998
notes 99, 398, 800, 1097
Maintenance ration of cattle, Pa 483

Page.

- **Maize.** (*See also* Corn.)
  - nutritive value 73
- **Malaria**, bovine 289
  - studies 92
- **Malic acid**, studies 614
- **Mallein problem**, review of literature 896
  - test for glanders 285, 495, 594, 896, 993
    - N. Dak 889
- **Malt diastase** for saccharification of starch 715
  - distillery, effect on alcohol in milk 284
  - extracts, examination 970
  - hulls, analyses, Conn. State 279
  - liquors, analyses, Conn. State 769
  - methods of examination 618
  - sprouts and molasses for cows 885, 888
    - description 971
- ***Mamestra legitima***, notes, U. S. D. A 472
  - *trifolii*, notes, U. S. D. A 471
- Mammals as affected by subcutaneous injections of sugar solutions 483
- Mammary gland, excretion of micro-organisms 286, 387
- Mammitis, gangrenous, of the goat 191
  - infectious, in Massachusetts 1087
- Man, conflict with climate, U. S. D. A 430
  - digestion experiments 175, 376, 479, 659, 660, 661 672
    - Me 959
  - foot-and-mouth disease in 695
  - metabolism experiments 67, 184, 376, 380, 672, 778, 1067
    - Me 960
    - U. S. D. A 374, 770
  - plants poisonous to, N. J 112
- Mandura beans, analyses 249
- Manganese, determination of alumina in presence of 618
- Mange mites of dogs as affected by "epicarin" 870
  - notes 793
- Mangel-wurzels, analyses 71
  - cost of production, Ind 340
  - culture experiments, Can 832
  - depth of planting, Can 631
  - fertilizer experiments 140, 838, 842
    - Can 632, 833
  - for pigs, Ind 667
    - sheep 773
    - steers 773
  - varieties 144, 842
    - Can 631, 633
  - vs. sugar beets for cows, Can 688
- ***Mangifera indica***, varieties 352
- Mango caterpillar, notes 1063
- Mangoes, varieties 352
  - S. Dak 51
- Manila weather, U. S D. A 30
- Mannose, production in carob seed 1056
- Manure, denitrification in the soil 830
  - kraal, analyses 526
  - liquid, for plants 242
  - of sheep, value 229
- Manures, animal, effect on marsh soils 627

Page.

- Manures, application [illegible]
  - homemade, care, N. C 497
  - of Egypt 437
  - relation to hygiene 33
- Maple, ash-leaved, cost of planting, Can 854
  - notes, Can 852, 853
  - black spot, notes, Mass. Hatch 568
  - hard, blight, treatment, N. J 563
  - leaf scorch, N. Y. State 358
  - scale, cottony 66
  - sirup, analyses, Conn. State 769
- Marchal, P., bibliography of writings 959
- Mares, breeding experiments with zebras 1077
  - distribution of galactase in milk, Wis 580
- Margarin and butter, manual 390
  - method of differentiating 112
  - cryoscopy 618
  - detection 814, 868
  - digestibility 376, 380, 659, 660
  - German laws relating to 1085
- ***Margarodes vitium***, notes 261, 477, 657
- ***Margaronia hyalinata***, notes, Ga 864
  - U. S. D. A 864, 952
  - *nitidalis*, notes, Ga 864
    - U. S. D. A 863, 952
- Marguerite fly, notes 1100
- Market gardening, irrigation in 294
- Marls, analyses, Conn. State 719
  - Ky 314
  - Mass. Hatch 137
  - determination of calcium carbonate 23
- Marmalades, analyses, Conn. State 769
- Marram grass, notes, U. S. D. A 423
- Marsh culture, recent progress 435
  - hay vs straw for steers, Can 876
  - lands of Kankakee, drainage 395
- ***Marsonia ochroleuca***, attacking chestnuts, N. J 752
  - *perforans*, affecting lettuce, Mich 58
- Marsupial excrement, analyses 230
- Maryland College, notes 297
  - Station, financial statement 897
    - notes 99, 297
- Massachusetts Hatch Station—
  - financial statement 899
  - notes 898
- Maté as a food 1075
  - protector 1070
- May beetles as food for cattle 174
  - notes, U. S. D. A 965
  - parasites 965
  - remedies 782
- Mayberry, golden, notes, Wis 159
  - Japanese, notes, Mich 252
- Meadow fescue, analyses, Conn. Storrs 882
  - seed, viability 158
  - grass, reed, poisoning cattle 796
    - seed, rough-stalked, viability 158
    - tall, culture experiments, S. Dak 43
  - grasses, fertilizer experiments 340
  - hay, productive value 771
  - lark, notes 428

Page.
Meadows, fertilizer experiments 644
  irrigated, fertilizer experiments 138
  irrigation 734
  management, Tenn 927
  manuring 842
  natural and artificial 319
  permanent, grass mixtures for, Can 632
Measles in meat of reindeer 91
Meat and bone, analyses, Mass. Hatch 138
  boiled, red color 279
  determination of fat 21
  extract, notes 672
  inspection in Germany 279
    Norway 693
    Shanghai, U. S. D. A. 984
    Sweden 91
  preserved, determination of boric acid 618
Meats, canned, examination, U. S. D. A. 67
Mechanics of cyclones 716
Medicago media, analyses 842
  sativa. (*See* Alfalfa.)
Mediterranean fruit fly, notes 563
Medlar, Japanese (*See* Loquat.)
Melampsora æcidioides, notes 468
  helioscopiæ, notes 468
  laricı-capræarum, notes 468
  of *Populus tremula*, relationship to *Cæoma fumariæ* 59
  populina, notes 468
Melampsorella caryophyllacearum, notes 948
Melanconium fulgineum, notes 59, 260
Melanophila fulvaguttata, notes 764
Melanoplus atlanis, notes 265, 766
    Minn 864
  bivittatus, notes 265
    U. S. D. A. 952
  differentialıs, notes 265
  femur-rubrum, notes 265
  packardi, notes 265
  spretus, notes 265, 766
Melica pamelii, n. sp., notes 319
Meligethes æneus, notes 765
Melilot, notes, N. Dak 339
Melittia satyriniformis, notes, U. S. D. A. 363, 952
Melolontha vulgaris, notes 273, 370, 562, 657, 762
Melon aphis, notes, Ga 864
  caterpillar, notes, U. S. D. A. 364
  louse, notes, Nebr 370
  wilt, treatment, Conn. State 754
  worm, notes, Ga 864
Melons, notes, Ariz 239
  Russian, varieties, Ariz 851
  spraying experiments, N. Y. State 270
  stock, varieties, Okla 1036
  varieties, Ariz 851
    S. Dak 51
Melophagus ovinus, notes 263
Meningitis and bovine tuberculosis 193
Menopon pallidum, notes 263
Mentha pulegium, notes 858
Mercury pump, new 214
  vent for distilling flasks 419
Merismopædia elegans on greenhouse plants 906
Meromuza americana, notes, Can 862
Meromyza americana, notes, N. Dak 264
Merulius lacrymans, notes 947
Mesquite pods, analyses 458
Metabolism as affected by alcohol 184
    muscular work 1067
  experiments with man 1067
  function of water 184
  of protein in plants 321
    sheep, methods of studying 773, 778
  with insufficient diet 381
Metal ties for railways 1050
Metals, effect on bouillon cultures of bac teria 123
Meteorological chart of the Great Lak U. S. D. A. 912
Meteorological observations—
  in Brazil 716
    England 820, 1018
      and Wales 1018
    France 31, 128, 821
    Java 911
    Massachusetts 1018
    New South Wales 517
    New York 430
    North Africa 821
    Russia 222
    Scotland 222, 517
    United States, U. S. D. A. 29
  permanent record, U. S. D. A. 127
Meteorological reports by cable from Iceland, U. S. D. A. 222
  service of Canada, U. S. D. A. 222, 430
  stations as stations of instruction, U. S. D. A. 127
    establishment and inspection, U. S. D. A. 127
    voluntary, U. S. D. A. 127
  statistics, improvement, U. S. D. A. 127
  waves, U. S. D. A. 30
Meteorology, Can 621, 820
  Colo 323
  Conn. Storrs 819
  Del 430
  Ga 30, 1018
  Ky 323
  Mass. Hatch 128, 222, 432, 715
  Md 820
  Me 912
  Mich 30, 1018
  Minn 323
  Miss 821
  N. Dak 821
  N. H 128
  R. I 911
  Utah 432
  Va 128
  Wyo 1017
  agricultural, U. S. D. A. 127
    treatise 129
  and agriculture in the Department of Hérault 599

Page.
Meteorology and physics in universities, U. S. D. A 430
universites, U. S. D. A 429
bibliography, U. S. D. A 221
by laboratory methods, U. S. D. A 819
elementary, U. S. D. A 429
importance to farmers 222
in Great Britain, U. S. D. A 222
Iowa, U. S. D. A 221
Russia, U. S. D. A 222
schools, U. S. D. A 127, 819
universities, U. S. D. A 621, 819
International Congress at Paris 1000
obscure points, U. S. D. A 222
present status, U. S. D. A 620
Methyl alcohol, occurrence in plants 121
cinnamate in *Alpinia malaccensis* 121
salicylate, occurrence in plants 121
Methylen-glucose 706
Metura elongata, notes 658
Mice, destruction by mouse typhus bacillus 1087
injurious, remedies 372
jumping, studies, U. S. D. A 429
Michigan College, notes 99
Station, financial statement 98, 1095
notes 99, 800
Microbes, effect on development of tubercle bacillus 394
Microcera sp. for combating San José scale, Ill 654
Micro-chemical analysis 509, 812
Micrococcus butyri-aromafaciens for ripening cream, Del 490
cruciformis, n. sp 713
spp., notes 468
Micro-organisms, excretion through mammary gland 286, 387
reaction in a colored nutrient medium 794
Microscope slide, new 318
Microscopic examination of water 133
Microsphæra caraganæ, notes 261
Microstroma americanorum, n. sp., notes 361
Miescheria, notes 894
Mignonette diseases, treatment, N. J 752
Mignonettes, breeding 453
Milk, absorption of odors, Wis 581
acid test for 688
adulteration 418
Ill 82
aeration in butter making, Can 681
cheese making, Can 683
alcohol content, as affected by feeding distillery malt 284
analyses 281
Ariz 213
Conn. State 769, 770
in Holland 587
and tuberculosis 790
antiseptics for, Wis 580
apparatus for analysis 23, 313
artificial, for calves and pigs 883
preparations 87
as affected by aphthous fever 493

Page.
Milk as affected by changing milkers 780
drought 676
food 86, 688
food, Miss 1080
freezing 886
nervous system of cow 779
sewage 282
bacterial content, Okla 886
causes of variation in quality 1085
chemistry and bacteriology, handbook 489
chromates as preservatives 984
clarification 984
combating disease in 390
composition, as affected by fatigue, Vt 384
composition, as affected by time of calving, Vt 389
condensed, analyses 307, 672
Vt 312
determination of fat 1100
manufacture 1085
container, sterile, N. J 714
control, nature in the future 984
cost of production, Can 885
N. J 884
curdling as affected by rennet extract, Wis 580
detection of adulterants 705
formaldehyde 213
formalin 904
salicylic and benzoic acids 705
boric acids 419
determination of acidity 578, 1007
added water 213
dirt 789, 1007
fat content 213, 419, 510, 904
solids and fat 905
digestibility 874
dilution methods, N. J 714
distribution of galactase, Wis 579
effect of micro-organisms on casein 1085
examination for tubercle bacilli 887
factors affecting richness 779
fat content as affected by fat in rations 484
content as affected by food 184
content as affected by food, N. Y. Cornell 1081
content as affected by pasturage 781, 782
contents, apparatus for determining 318
determination 213, 311, 419, 904
effect on cheese, Can 684
source 281, 973
fever, etiology 693
notes 995
treatment 190, 288, 593, 606, 796
filter, Kröhnke 284
fistula in a goat 288
flow as affected by fatigue, Vt 384
fluctuations under different conditions, Del 486

Page.

- Milk, "germ-free" for infants ... 889
  - heating for butter making, Pa ... 84
  - human, analyses ... 1007
  - in different forms, rapidity of digestion, Conn. Storrs ... 874
  - infection with tuberculosis ... 678, 679
  - inspection in Philadelphia, Del ... 185
    - Shanghai, U. S. D. A ... 984
  - keeping in hot weather, Kans ... 487, 498
  - killing germs of tuberculosis in, U. S. D. A ... 999
  - maintaining quality throughout the year, N. J ... 884
  - methods of handling ... 587
    - setting, Mich ... 186
  - monthly variations in composition ... 1084
  - new bacilli causing butyric fermentation in ... 688
    - coagulating ferment ... 888
  - normal, occurrence of leucocytes ... 701
  - of cows, albuminoid bodies ... 904
    - Genoa, tuberculosis in ... 688
    - tuberculous cows for calves, Conn. Storrs ... 890
  - pasteurization in butter making, Can ... 681
    - law in Denmark ... 790
  - pasteurized for butter making ... 682
    - Storch test for ... 785
  - pathology ... 677
  - preparation ... 587
  - preservation, Okla ... 386
    - U. S. D. A ... 599
    - W. Va ... 583
  - preservatives ... 582
  - preserving with formaldehyde ... 587
  - production and inspection ... 1085
  - production as affected by—
    - food ... 284
    - pasture ... 587
    - period of lactation, Del ... 486
    - protein, Mass. Hatch ... 577
    - spaying ... 86, 696
  - production, cost ... 490
    - N. J ... 784
  - products, analyses ... 281
    - bacterial examinations ... 977
  - quality as affected by food ... 489
  - regulations of sale in Prussia ... 790
    - Saxony ... 790
  - relation to tuberculosis infection of the lymphatic system ... 592
  - richness in cows of mountain breeds ... 185
  - ropiness, studies ... 284
    - N. Y. Cornell ... 282
  - ropy, U. S. D. A ... 999
  - samples, preservation, Can ... 681
    - Vt ... 385
  - secretion as affected by alcohol ... 973
    - rations rich in fat ... 587
    - studies, N. Y. Cornell ... 384
  - setting at different temperatures, Can ... 685
  - skimming, mechanical ... 490
  - solids, apparatus for determination ... 313
  - sour, handling in cheese making, Wis ... 585
    - preparation for analysis ... 211

Page.

- Milk, spontaneous curdling ... 489, 789
  - sterilization ... 393
  - sterilized, digestibility ... 882
    - pasteurized and raw compared ... 87
  - studies on fat globules ... 186
  - supplies, bacterial tests in sanitary supervision ... 1083
  - supply and tuberculosis ... 588
    - as related to infant mortality ... 588
    - of Chicago, Ill ... 82
      - cities, handling ... 390
      - Turin, purity ... 490
  - test, Babcock ... 284
    - modification, Vt ... 389
    - in factories, improvement ... 188
    - Storch method ... 789
  - testing for nitrates ... 87
  - tests at fairs and on farms, Can ... 689
    - inspection, Vt ... 482
    - turbine Babcock testers as cause of incorrectness ... 1083
  - turnipy taste ... 81
  - typhus bacillus in ... 786
  - uniformity of composition ... 188
  - watered, effect of rennet on, Wis ... 581
  - yield, as affected by fatigue, Vt ... 384
    - pasturage ... 782
- Milking, sanitary management ... 888
- Millet, barnyard, digestibility, Mass. Hatch ... 566
  - composition, Mo ... 1076
  - culture experiments, S. Dak ... 43
  - digestibility, U. S. D. A ... 589
  - diseases, notes, Mich ... 58
  - glucosid, N. Dak ... 214
  - grass of Australia, notes ... 220
  - Japanese, analyses, N. J ... 777
    - broom corn, analyses, N. J. ... 777
    - notes, Can ... 833
  - pearl, notes, Mich ... 1037
  - varieties ... 538
    - Can ... 631, 632
    - Mich ... 43
  - water absorption of seed ... 1056
- Millets, classification of varieties, U. S. D. A. ... 443
- Milling experiment station ... 299
- Millo maize, analyses, Okla ... 277
- *Miltonia bleui*, notes ... 352
- Mina, notes, U. S. D. A. ... 426
- Mince meat, analyses, Conn. State ... 769
- *Mindarus abietinus* on the white fir ... 564
  - sp., notes ... 657
- *Mineola indiginella*, notes, Ky ... 170
- Mineral elements, absorption by plants ... 121, 216
  - matter in soils, determination ... 131
  - nutrients, physiological rôle, U. S. D. A ... 1008
  - phosphate as a fertilizer, Can ... 833
  - salts, decomposition by humus ... 623
- Mineraline for adulterating flour, N. C ... 278
- Minerals, analyses ... 314
- Minnesota plant life, handbook of ... 1014
  - Station, financial statement ... 396
    - notes ... 199
- Minnetonka Lake watershed, hydrology, U. S. D. A ... 221

Page.
Mirobia and seiches, U. S. D. A 222
Mississippi Station, financial statement 897
  notes 600
Missouri College, notes 99, 899
  Station, circular of information 898
    financial statement 1095
    notes 99, 800, 899, 1000
  watershed, laws for acquiring titles to water, U. S. D. A 96
  watershed, water rights, U. S. D. A 95
Mist, small whirling columns, U. S. D. A 620
Mistletoe, notes 368
Mites of Portici 1065
Mixed feed, analyses 381
    Conn. State 279
    Me 971
  fertilizers, analyses, Mass. Hatch 137, 528
    N. J 830
Moisture, distribution in the United States, U. S. D. A 30
  effect on butter 584
    germination 1056
  in air, effect on stomata 115
Molasses, analyses 75
    Conn. State 770
  as a feeding stuff 80
  determination of ash 213
  feed, analyses 71
    determination of sugar 311
    valuation 505
    vs. barley and corn for pigs 69
  feeds, determination of molasses content 311
  for farm animals 778
    U. S. D. A 999
  horses 74
  refuse, analyses, Can 873
    as a fertilizer 1025
Molds, genetic relation to alcohol yeasts 125
  growth as affected by salt 683
Mole cricket, remedies 1065
Molecular concentration of culture media as affected by bacteria 715
Molybdenum, separation from tungsten 813
Monarch corn-and-oat feed, analyses, Me 279
Monardia sp., dimorphism 870
Mongoose, notes, U. S. D. A 426
Monilia blight, notes 465
  diseases of plants 949
  variations due to culture media 949
Monilia fructigena, notes 465
    Conn. State 757
    Oreg 466
Monocotyledons, grafting 910
Monocrepidius vespertinus, notes, U. S. D. A 952
Monophadnus rubi, notes, N. Y. State 63
Monosodium phosphate, precipitation by magnesia mixture 108
Monstrosities in rye 540
  principles of culture 546
Montagnella maxima, n. sp., notes 469
Montana College, notes 1097
  Station, financial statement 295, 1095
    notes 1097
Montanoa, revision of genus 121
Moor lands of Prussia, improvement 442
  soils, grasses for 43
  of Westphalia 134
Morbus maculosus of horses, treatment 96
Morning glory, eradication, Wis 749
  notes, Iowa 651
Morphology of alcoholic ferments 125
Morrow, Prof. G. E., services to agricultural education 1003
Mortierella van tieghemi, notes 428
Mosquitoes, notes 272, 457
  remedies 457
Moths attacking fruits, Minn 170
  migration 765
"Mottled top" of tobacco, notes, Conn. State 455
Mount Tamalapais observations, value, U. S. D. A 126
Mountain forests, restoration 456
  peaks, minimum temperatures, U. S. D. A 621
Mouse destroying bacteria, notes 393
  diseases, pathological anatomy 393
  typhus bacillus for destroying mice 1087
Mowers, draft, Mich 96
Muck, analyses, Can 831
    Mass. Hatch 1026
    Vt 313
  land, fertilizer experiments on, Mich 1037
Mucor mucedo, effect in ripening cheese 787
  racemosus in combating locusts 659
  stolonifer, notes 164
Mucuna utilis, notes, U. S. D. A 341
Mulberry borer, notes 272
  culture in Russia 548
  Russian, as wind-breaks 550
Mulches, effectiveness, Wis 521
Mulching, effect on soil moisture and temperature 619
  orchard fruits with seaweed 548
Mules, feeding experiments, Okla 1069
  tuberculosis 393
Murgantia histrionica, notes, U. S. D. A 952
Muriate of potash, analyses, Conn. State 719
    La 39
    Mass. Hatch 137, 528, 1026
    N. J 830
    R. I 917
Muscidæ, notes 272
Muscinæ of North America, studies 1065
Muscle, brain, and diet, treatise 882
  exhausted, effect of nutrients in restoring 778
  exhaustion as affected by sugar 67
Muscular tissue, phosphorus content, as affected by work 778
  work as affected by certain stimulants 79
    effects on metabolism 1067
    respiratory quotient 72
Mushroom poisoning and remedies 121
Mushrooms as food 184
  culture 451
  edible, N. H 158

Page.
Mushrooms, growing on benches 649
notes ? 1047
N. Y. Cornell 322
Muskmelon black mold, Conn. State 755
disease caused by Alternaria, Mass. Hatch 552
wilt, notes, Ohio 357
Muskmelons, fertilizer experiments, N. J 445
grafting 153
physiological disease, Conn. State 755
pollination 707
Mustard, adulteration 970
annual, Nebr 315
as affected by fungicides 462
dross, effect on wireworms 767
oil from rape-seed cake 22, 619
water absorption of seed 1056
white, effect of different phosphates 436
wild, as the cause of tympanitis 592
eradication 159
Wis 749
Musts, determination of acidity 618
reducing sugars 509
eudiometric method for determination of acidity 618
Mutillidæ of North America, monograph 66
Mycelium of aerial parts of plants, nitrogen assimilation 1016
Mycetophagidæ, monograph 562
Mycoplasma theory of Eriksson 1060
Mycorrhiza, endotropic, studies 322, 910
Myelin, preparation from egg yolk 510
Myodocha serripes, notes, U. S. D. A 952
Myology, veterinary, nomenclature 285
Myoporum acuminatum, poisonous to stock 1057
deserti, poisonous to stock 1057
Myriapods as carriers of disease 995
n. sp., notes 265
Myrmeleon, study 657
Mystrosporum aductum, n. sp., notes 360
alliorum, notes 360
Mytilaspis affecting citrus fruits 657
Mytilaspis gloveri, remedies 372
pomorum, notes 274
Iowa 958
U. S. D. A 952
on American fruit 655
Myzus cerasi, notes 562, 657
ribis, notes 657
Narcosis of animals, notes 291
Nasturtium diseases, treatment, N. J 752
National Geographic Society, U. S. D. A 429
Nebraska Station, financial statement 397
notes 199, 297, 499
University, notes 297
Necrosis bacillus, notes 291
Nectarines, fruit development as affected by seed development 936
Nectarophora destructor, notes, U. S. D. A 952
n. sp., notes, U. S. D. A 953
tabaci, notes, U. S. D. A 472
Nectria bainii, notes 556
n. sp., notes 362
Nectria cinnabarina, conidia formation 516
ditissima, cultures 950
notes 260, 758
Negroes, dietary studies, U. S. D. A 961
Nematode diseases of plants 167
galls, notes, Ga 173
worm disease of fowls 594
worms affecting sugar beets 1057
remedies 372
Nematodes of coffee roots 262
cultivated plants 259
tobacco, treatment 711
remedies 429
Nematus erichsonii, notes, Can 657
ribesii, notes 765
Neuta of goats, remedies 493
Neocosmospora vasinfecta, notes, U. S. D. A 944
nivea, notes, U. S. D. A 944
tracheiphila, notes, U. S. D. A 944
Neotia nidus-avis, germination 355
Nepenthes, proteolytic enzym 124
Nepticuea nigricansella, notes 958
Nest box for individual egg records, Me 969
Neuritis, enzootic, of sheep 93
Neuroterus q-saltatorius, notes, Mich 954
Nevada Station, financial statement 898
notes 800
University, notes 800
New Hampshire College, notes 200
Station, financial statement 197, 898
notes 199, 297
New Jersey Stations, financial statement 799
notes 297
New Mexico College, notes 899, 1000
Station, notes .. 298, 398, 499, 899, 1000
Nicotiana suaveolens, notes 220
Nicotin as an insecticide 474
decomposition by enzyms, U. S. D. A 728
detection 705
formation and combustion 576
in tobacco, determination 22
Night soil, notes 1025
Nightshade, black, notes 858
deadly, poisoning, treatment 495
Nile mud as a fertilizer 135
Niter earth, analyses, Ky 314
Nitidulidæ, monograph 562
Nitragin, effect on root tubercles 25, 711
yellow lupines 515
experiments 26
Can 816
Mass. Hatch 516
Me 908
N. Dak 218
R. I 908
increase of efficiency 318
studies 29, 424
Nitrate of potash, analyses, R. I 917
Nitrate of soda. (*See also* Sodium nitrate.)
admissible content of perchlorate 917
analyses, Conn. State 719
Mass. Hatch 138, 528

Page.
Nitrate of soda—Continued.
analyses, Minn 831
N. J 830
R. I 917
and blood meal for flax 42
as a fertilizer 831
availability for grass, Conn. State 722
containing perchlorates, effect 1026
determination of perchlorates and chlorates in 505
sodium perchlorate... 110
for forage crops, N. J 439
industry of Chile 138, 528
injurious effect on rye 239
Nitrate-reducing bacteria, straw as culture medium.
soluble ferments in animals 715
Nitrates, assimilation by plants 221
determination 21, 811
in milk, detection 87
nitrogen, determination 311
soil, decomposition 32, 331, 831
water and ammonia, determination 112
detection 419
Nitric acid in water, determination 312, 705
reaction in water examination.. 811
Nitrification as affected by organic substances 424
Nitrifying bacteria, isolation 827
organisms as affected by organic material 711
Nitrites, analysis 112
determination 21
Nitrobacteria as affected by laboratory air. 125
Nitrobenzene azoguiacol as an indicator ... 214
Nitrogen, apparatus for determination 23
assimilation by Alinit bacteria ... 1016
fungus mycelium. 1016
plants 25, 26
R. I 29
experiments 121
of legumes as affected by removal of flowers 516
studies 1013
compounds, formation and combustion .... '576
content of barley as related to weight of grain 633
determination 106
Kjeldahl method... 20
effect on yeasts 125
equilibrium in man 1067
excretion as affected by large quantities of water 778
fixation as affected by sugar 516
by algæ 516
hunger and coffee disease 1061
in nitrates, determination 311
source of error 311
organic substances, determination 306
potassium nitrate, determination 705
Nitrogen, loss from feces in drying, Mo 1095
urine in drying, Mo 1095
metabolism of, U. S. D. A 374
nitric, apparatus for determination 312
vs. ammoniacal nitrogen ... 831
of amids or amido acids 813
barnyard manure, relative value 435
dried blood and leather refuse for rye, Mass. Hatch 528
proteids 510, 813
the atmosphere, acquisition by soil inoculation, Me 898
urea, modified method for determining 813
organic, as a fertilizer 134
assimilation by plants ... 316
availability in fertilizers, N. J 720
availability in fertilizers, Vt 328
problem, notes 911
total, determination in peptic digestion 971
utilization by plants 547
Nitrogenous fertilizers, effect on protein in grasses and legumes 723
tests, N. J 444
superphosphates and guanos, analyses, Conn. State 719
Nitrous acids in water, determination 312
Noctua fennica, remedies, Can 862
Noctuidæ, North American, description of larvæ 265
Nodonota puncticollis, notes, U. S. D. A 366
tristis, notes, U. S. D. A 366
Normandy cattle, notes, U. S. D. A 983
North Carolina College, notes 200, 298
Station, financial statement. 1095
notes 199, 298, 600
North Dakota College, notes 200
Station, financial statement. 898
notes 199, 298, 600
Notolophus leucostigma, notes, U. S. D. A ... 952
Novius koebelei, importation into California. 558
Nucleones, solubility in salt solutions 706
Nurse crops for grass lands, N. H 140
Nursery cuttings, planting 51
inspection 275,
Conn. State 270
Ind 657
Ky 170
Va 867
in Montana
Ontario 558
stock, national inspection law 764
protecting from excessive cold, Wis 931
in winter 548
root injured, experiments in pruning and banking . 549
killing 244
Nut-bearing trees, varieties, Okla 1036
grass, eradication 750

Page.
Nut grass, notes ... 858
Nutmeg, culture in the Dutch East Indies ... 1048
  fruit, dehiscence ... 121
  trees, grafting ... 548
Nutrition, chemistry of, manual ... 482
Nuts, fertilizer experiments, N. C ... 341
  physical analyses ... 872
Oak caterpillar, notes ... 564
  leaf blight, notes, Mass. Hatch ... 552
  leaves, persistence under influence of blue rays ... 907
  plantations, management ... 1050
  pruner, notes, Conn. State ... 762
Oat and fine rowen hay, digestibility, Conn. Storrs ... 874
    pea fodder, analyses, Conn. Storrs ... 882
      digestibility, Conn. Storrs ... 874
  bran, analyses, Me ... 971
    Minn ... 883
  chaff, analyses, Conn. State ... 279
  crop of Hungary, 1899, U. S. D. A ... 698
  crown rust, U. S. D. A ... 943
  dust, analyses, Can ... 873
  feed, analyses, Conn. State ... 279
    Minn ... 883
    description ... 971
    digestibility, Conn. Storrs ... 874
      Mass. Hatch ... 566
    Quaker, analyses, Conn. State ... 279, 777
      Conn. Storrs ... 882
      Me ... 279, 971
      N. J ... 737
  grains, analyses, Can ... 617
  grass seed, tall, viability ... 158
  hay, analyses, Me ... 971
    Minn ... 883
    composition at different stages of maturity, Me ... 965
    digestibility, Me ... 965
    effect of different fertilizers on feeding value ... 1072
  hulls, analyses, Can ... 617
  meal by-products, analyses, Mo ... 1076
    dust, analyses, Can ... 873
  middlings, analyses, Me ... 971
  screenings, analyses, Can ... 873
  shorts, analyses, Can ... 873
  smut, loose, Nebr ... 314
    prevention, Ohio ... 162
      R. I ... 944
    treatment, Ind ... 356
Oatena, analyses, Me ... 971
Oats, analyses, Conn. State ... 279
    N. J ... 777
  and barley vs. corn for cows ... 780
    peas, analyses, Minn ... 883
      N. J ... 777
      as soiling crops for cows Can ... 688
      culture experiments, S. Dak ... 43
      digestibility, Mass. Hatch ... 566
    tares as soiling crops for cows Can ... 688
    vetch, culture experiments, S. Dak ... 43
Oats and vetch, digestibility, Mass. Hatch ... 566
  as a cover crop, Mich ... 1047
    affected by nitrogenous fertilizers ... 589
    affected by nitrogenous fertilizers, Conn. Storrs ... 836
  ash analyses ... 37
  Belgian black ... 540
  broadcasting vs. drilling, Can ... 629
  Canadian, in India ... 144
  culture, Can ... 642
    experiments ... 42, 540
  effect of temperature on germination ... 156
  fertilizer experiments ... 36, 332, 539, 842, 1027, 1028, 1036
    Can ... 632
    Ga ... 841
    Mass. Hatch ... 530
  germination tests, Can ... 857
  growing mixed varieties ... 1037
  milling value as affected by fertilizers ... 1028
  mixed seeding, Ohio ... 235
  notes, Mich ... 1037
  nutritive value ... 78
  preparation of soil, Mich ... 40
  root system, N. Dak ... 215
  seeding, Ohio ... 235
  seed selection, Can ... 630
  valuation ... 241
  varieties ... 42, 145, 442
    Can ... 629, 632
    Ga ... 842
    Mich ... 43
    N. Dak ... 332
    Ohio ... 234
    Okla ... 1036
    R. I ... 944
  viability ... 158
  vs. barley for horses ... 80
  water absorption of seed ... 1056
    requirements as affected by different fertilizers ... 923
  winter, acclimatization ... 241
    varieties ... 442
Oberea bimaculata, notes, Ohio ... 63
  ocellata, notes, U. S. D. A ... 366
Ocean temperature as related to vegetation period ... 223
Ochroes, unripe, analyses ... 249
Ocneria dispar. (*See* Gypsy moth.)
Odontota dorsalis, notes ... 477
  U. S. D. A ... 952
Œcanthus fasciatus, notes, U. S. D. A ... 472
  niveus, notes ... 871
Œcophora oleœlla, notes ... 474
Œdema, malignant, differential diagnosis, U. S. D. A ... 985
  in cattle ... 796
Œdocephalum albidum, development ... 910
Œsophagostoma columbianum, notes, U. S. D. A ... 986
Œstridæ affecting domestic animals ... 1090
  economic importance ... 564
Œstrus ovis, notes, Miss ... 272
Ohio Station, notes ... 199, 398, 499, 1000
Oidium, time for treatment ... 759

Page.
Oidium fructigenum, notes 164
lactis, effect in ripening cheese 787
tuckeri, notes 59, 260
treatment 469, 556
Oiketicus macleayi, notes 658
Oil cakes as a fertilizer 136
of ricinus, studies 287
digestibility 376
for sprinkling roads 197
seeds, notes 294
Oils and wool waste, spontaneous combustion 1100
detection of cotton-seed oil in 811
essential, chemistry 618
ethereal for fungi 168
vegetable, treatise 482
Oklahoma College, notes 99, 398, 699
Station, financial statement 1096
notes. 99, 199, 398, 699, 800, 1098
Oleomargarin, adulteration 380
tubercle bacilli content 790
Olive and cotton-seed oils, differentiation .. 23
diseases, notes 59
dry rot, notes, Cal 46
industry in California 154
knot, notes, Cal 46
leaf disease, notes 59
spot, notes 362
Cal 46
oil cake, feeding value 576
detection of adulteration 23
peacock leaf spot, Cal 46
scale, black, notes, Cal 46
sooty mold, notes, Cal 46
spot disease, notes 949
twig borer, notes, Cal 46
Olives, analyses 647
Cal 46
and olive-oil manual 744
ash analyses 648
bacterial rot, notes, Cal 46
bird's eye, treatment 554
culture 252
Cal 46
fermentation 125
fertilizer requirements 647
insect enemies 474
variations in size and composition, Cal 46
varieties, Cal 47
Omphalitis in calves, etiology 797
Oncideres cingulatus, life history 1066
Onion seed, viability 158
germination tests, Conn. State . 748
smut, inoculation experiments, N. J . 752
thrips, notes, Nebr 370
Onions, autumn vs. spring sown 251
cold storage 153
fertilizer experiments, Mass. Hatch 529
notes, Ariz 851
S. C 1047
transplanting, Ark 244
varieties, Mich 250
S. Dak 51
wild, notes 858
Oogenesis in *Pinus laricio* 28

Page.
Oospora nicotianæ, n. sp., notes 515
scabies. (*See* Potato scab.)
Ophiobolus herpotrichus affecting cereals ... 1057
remedies 959
Opuntia rot, notes 59
Opuntias, breeding, Ariz 842
Orange hawkweed, notes, Vt 354
leaf spot, notes 759
orchards, covering 744
root rot, treatment 1048
sooty mold, U. S. D. A 463
Orangery, covered 154
Oranges, propagating by nurse roots 847
pruning 1047
stocks for 1048
treatment for scale insects 372
Orchard fumigation, Cal 64
grass, analyses, Conn. Storrs 882
bacteriosis 759
notes, N. Dak 339
seed, impurities, Mich 54
viability 158
insect pests affected by spraying .. 765
trees, leaf disease 861
Orchards, cover crops for, Mich 1047
culture, Me 153
insects affecting 274
inspection 275
irrigation in winter, Ariz 847
self-sterility 851
spraying experiments 167
Orchid beetle, remedies 174
breeding, curiosities 52
bug, remedies 174
family, limits of hybridization in ... 52
hybrids 52
new 353
hybrid 549
roots, habits of growth 454
Orchids, germination 355
Orcus chalybeus in South Africa 760
Oregon Station, notes 1098
Organic analysis with compressed oxygen. 213
material, effect on nitrifying organisms 711
nitrogen as a fertilizer 134
Orgyia antiqua, notes 870
Ornamental plants, notes, Can 850
shrubs, hardy, Kans 498
notes, Can 855
pruning 852
varieties 852
tree planting, notes 745
trees and shrubs, insects and fungi affecting 477
Russian, tests, Iowa 647
varieties 852
Ornithobius, notes 263
Orobanche on clovers, destruction 159
Orthezia insignis, notes 273, 564
Orthoptera, systematic position 562
Orygia postica, notes 273
Oscillaria subtilissima on greenhouse plants 906
tenuis on greenhouse plants 906
Oscinis carbonaria, notes, Can 862
frit, notes 658

Page.
Oscinis frit, remedies 959
maura, attacking Scotch firs 263
Osmogenic organisms 714
Osmotic pressure of sodium chlorid solutions 419
Ossein, analysis methods 1100
Ostomidæ, monograph 562
Otiorrhynchus picipes, notes 264, 766
Oven, electric drying 318
Owl, long-eared, feeding habits 428
Owls, feeding habits 428
Ox botfly, notes, Miss 272
gadfly, notes 263
warble fly, notes 263
Oxalic acid, inverting power on sucrose 20
Oxeye daisy, eradication, N. H 159
Wis 749
notes, U. S. D. A 599
Oxycarenus hyalipennis, notes 563
lugubris affecting cotton 1063
Oxydase for coloring wine 294
Oxygen, compressed, in organic analysis 213
content of water as affected by electricity 133
effect on fermentation 122
in water, determination 213, 312
Oxyopisthinæ, notes 767
Oxyptilus tenuidactylus, notes, U. S. D. A 952
Oyster-shell lime, valuation 528
Oysters, studies 426
Ozone for sterilizing water 133, 328, 718
Pacific coast, August weather, U. S. D. A 621
Northwest, cause of mildness of temperature 622
Pachynematus extensicornis, notes, Ohio 63
Pachytylus migratorius, remedies 658
Packing cases, inspection of 958
Palmin, digestibility 660
Palm-nut cake for cows 1084
meal, effect on milk fat, N. Y. Cornell 1082
vs corn for pigs 70
Pamperos storms, U. S. D. A 429
Pamphila, new species 174
Pancreas extract as affected by borax 962
Pancreatic and peptic digestion 576
Panic grass, bitter, notes, U. S D. A 423
creeping, notes, U. S. D. A 423
Panicum albomaculatum, n. sp., notes 1015
colonum, notes 220
decompositum variety, notes 220
inflatum, n. sp., notes 709
maximum, notes 482
multiramеum, n. sp., notes 1015
octonodum, n. sp., notes 709
ovinum, n. sp., notes 709
pilosum macranthum, n. var., notes 1015
thurowii, n. sp , notes 709
viscidellum, n. sp., notes 1015
Pansy disease caused by Colletotrichum, treatment 553
evolution and synonymy 154
new disease 257
Paraffin as an adulterant of oleomargarine 380
Paralysis of bees, notes 271
Mich 61

Page
Paralysis of the spinal cord in the horse 394
Paraplectrum fœtidum, effect in ripening cheese 787
Parasite of grape black-rot fungus 357
Parasites, animal, notes 1100
cryptogamic, causing plant diseases 555
for controlling injurious insects 175
fungus, of cultivated Rosaceæ 166
of wheat 59
relationship to hosts, N. Dak 817
Parasitic fungi of Vermont 356
Parastasia, sexual dimorphism 870
Parchment paper, relation to mold of butter 682
Paris green, analyses, Idaho 314
Ky 314
La 67
detection of adulteration 22
determination of arsenic 313, 614
for codling moth 765
sawfly, Md 62
law, La 67
methods of applying, Can 658
preparation and use 273, 371
preparation and use, Mass. Hatch 174
preparation and use, Me 262
Parlatoria affecting citrus fruits 657
monograph 476
Parlatoria, n. sp. notes 870
Parrots, agency in transmitting lung diseases to man 793
septicæmia 291
Parsley leaf spot. notes 759
Parsnip, wild, eradication, Wis 749
Parsnips, culture 241
varieties, S. Dak 51
Passion vine, notes, Okla 354
Pasteurization apparatus for home use, Mich 387
tests 887
at high temperatures, effect on quality of butter 85
effect on churning 680
in butter making, U. S. D. A 296
of cream, effect 786
wine 126
Pasteurizing and sterilizing apparatus—
new, N J 714
tests 390
Pasturage, effect on fat content of milk 781, 782
milk production 587
for restoring denuded forest areas 941
grain feeding with, for sheep 779
Pasture grasses, fertilizer experiments 339
notes, Ala College 145
summer, tests of forage plants, Nebr 279
Pastures, fertilizer experiments 641
making and care, N. C 497
management, Tenn 927
seeding, N. C 1032
treatment in Switzerland 734
Pathology, investigations in Italy in 1898 591

Page

Pawpaw, uses 744
Pea-and-barley fodder, analyses, Conn. Storrs 882
    digestibility, Conn. Storrs 874
  oat fodder, analyses, Conn. Storrs 882
    digestibilty, Conn. Storrs 874
  Canada field, analyses, Pa 436
  fodder crops, Can 632
  hay, analyses, Minn 883
  louse, green, remedies 1099
    notes, U. S. D. A 953
  mildew, treatment, N. J 752
  moth, notes 957
    Can 863
    remedies 558
  stem blight, treatment, N. J 751
  weevil, notes, Can 863
    U. S. D. A 470
Peaberries on coffee trees 744
Peach aphis, black, notes, Ky 170
      Ohio 472
      remedies, Mich 64
    notes, Can 929
  black spot, notes, Can 929
  blossoms, apparent resistance to frost 252
  buds, winter protection, Kans 498
  crown gall, notes, Mich 57, 1088
  culture in Canada 929
    Kansas 744
    Maryland 937
    New Jersey 51, 937
  curculio, notes, Can 929
  diaspis, remedies 958
  diseases, notes 59
    Can 929
    Ga 167
  fruit spot, notes, Ky 170
  leaf curl, notes, Can 929
      Mass. Hatch 552
    treatment 260, 470
      Can 651
      Mich 1059
      N. Y. Cornell 164
      Ohio 357
  mildew, notes, Can 929
  root borer, remedies 558
    galls, notes, Can 929
      N. J 753
  rosette as a possible cause of mosaic disease of tobacco 360
    notes 369
      Ky 170
  rot, notes, Can 929
  scale, new, notes 369
    notes, Ohio 63
  tree borer affecting plum trees, Wash 1064
    notes 371, 470, 563, 955
      Can 929
      Ga 173
      Mo 268
  trees, abnormal growths 556
    gum disease, Mich 57
  twig borer, notes 955
      Kans 498
  yellows as a possible cause of mosaic disease of tobacco 360

Page.

Peach yellows, notes 369
      Can 920
      Ky 170
      Ohio 357
Peaches as affected by spring frost, N. Mex. 1044
    unusual cold, Ala. College 1041
  bud development 851
  classification 1048
  close root pruning 1047
  culture 351, 851
  factors of hardiness 251
  fertilizer experiments, Ga 148
    requirements 45
  grafting on currants 850
  irrigation in winter, Ariz 847
  notes, S. C 1047
  parasitic diseases 949
  premature ripening, N. J 754
  resistance of foliage to insecticides and fungicides, Ga 147
  root pruning, Del 845
  shot-hole effect 757
  stone splitting 252
  varieties 251
    Can 547, 930
    Ga 147
    Mich 153, 252
    N. J 51
    N. Mex 1044
    Okla 929, 1036
Peanut and cotton-seed oils, differentiation. 23
  cake vs. malt sprouts and molasses for cows 885
  meal vs. brewery residue for cows 81
  oil, acids 23
  soils, analyses 842
Peanuts, breeding, N. C 1032
  methods of planting, Ark 923
  production in India 842
  Spanish, ash analyses, La 231
    culture experiments, Ark 927
Pear blight, bacterial 260
    notes, Colo 314
      Ky 170
      N. J 753
  blister moth, remedies 956
  borer, sinuate, remedies 273
  culture in Florida 52
  leaf blight, notes 260
    blister mite, notes, Ky 170
    spot, notes 759
  midge, notes 169, 272
  psylla, notes 173, 370
    Conn. State 762
  sawfly, remedies 766
  scab, notes 260, 556
    N. H 255
  tree aphis, notes 957
    diseases, notes 167
  trees affected by woolly aphis 476
    pruning 548
Pears, analyses 51
  as affected by unusual cold, Ala. College 1041
  ash analyses 157, 229

Page.

- Pears, bud development 851
  - close root pruning 1047
  - evaporation 851
  - fertilizer requirements 45
  - fruit development as affected by seed development 936
  - injury by Bordeaux mixture 950
  - iron content 157
  - notes, S. C 1047
  - parasitic diseases 949
  - prickly, analyses 314
  - root pruning, Del 845
  - Russian tests, Iowa 647
  - spraying experiments 258
  - varieties 154, 251, 451
    - Can 547, 844, 850
    - Mass. Hatch 544
    - Mich 153, 252
    - Mont 251, 1048
    - N. H 152
    - Okla 929, 1036
- Peas, analyses, Idaho 314
    - N. Dak 219
    - N. J 737
  - and barley, analyses, N. J 777
    - oats, analyses, Minn 883
      - N. J 777
      - digestibility, Mass. Hatch 566
  - ash analyses 37
  - broadcasting vs. drilling, Can 628
  - culture, Can 642
    - experiments, S. Dak 43
  - damping off, Conn. State 757
  - double cropping with tomatoes, N. J 739
  - English, notes, S. C 1047
  - extent of variation, N. J 736
  - fertilizer experiments 37, 842
  - field, N. Dak 339
  - for canning, culture 937
    - green manuring, Ariz 833
  - green, louse, notes 871
  - Idaho, culture experiments, Colo 339
  - inoculation experiments, Can 816
    - N. J 753
  - liming, N. J 739
  - notes, Ariz 850
  - nutritive value 73
  - seed selection, Can 630
  - softening on boiling as affected by soils and fertilizers 451
  - spraying experiments, N. J 752
  - studies of pods of different varieties, N J 736
  - sugar, attacked by Physopoda 1066
  - temperatures for germination 1056
  - thickness of sowing, N. J 737
  - training 736
  - varieties 442, 842
    - Can 628, 632, 845
    - Mich 250
    - N. J 736
    - S. Dak 51
  - vs. corn for lambs, Can 666
    - steers, Can 665
  - water absorption of seed 1056
  - yields on old and new lands, N. J 753

Page.

- Peat as a fruit preservative 250
  - bog ashes, analyses, Minn 831
  - manure, analyses 626
  - rotted, analyses, Conn. State 719
  - vs. straw as litter 438
- Pectin of the gooseberry 906
    - quince 906
- Pectins, notes 214
- *Pediculoides ventricosus*, notes 767
- Pediculus, notes 263
- *Pegomyia vicina*, notes, Mich 954
- Pelargoniums, breeding 453
- *Pellicularia koleroga* affecting coffee 1065
    - on coffee, treatment 1060
- *Pemphigus acerifolii*, notes, U. S. D. A 952
  - *boyeri*, notes 765
- *Penicillium brevicaule* as a test for arsenic 652
  - *crustaceum*, causing mold of butter 683
  - *glaucum*, development 910
    - existence in solutions of organic salts 910
    - in Roquefort cheese 788
    - notes 164
  - *luteum*, notes 164
- Penicillium, effect in ripening cheese 787
    - on butter fat 977
- Pennsylvania Station, financial statement 496
    - notes 298
- Pennyroyal, notes 858
- *Pentilia misella*, notes 1100
- Pentosans, determination 213
- Peony disease, treatment 167
  - diseases, treatment, N. J 752
- Pepper, adulteration 970
  - black, analyses, Idaho 314
- Pepsin as affected by borax 962
  - method for availability of nitrogen, N. J 720
- Peptic and pancreatic digestion 576
  - digestion, determination of products 510, 971
- Peptones, determination 311 813
    - in peptic digestion 971
- Perchlorates and chlorates in nitrate of soda, determination 505
    - in nitrate of soda, effect 1026
- Percolation, effect on elevation of ground-water surface 517
- "Perezol" as an indicator 814
- Perfumery farming in the United States, U. S. D. A 450
- Perfumes, artificial, chemistry 618
  - plants producing 453
- Pericarditis traumatica of cattle, diagnosed by digitalis 289
- *Peridermium plowrighti*, notes 262
  - *strobi*, notes 949
- *Peridroma saucia*, remedies 1065
- *Periplaneta orientalis*, digestive organs 767
- Peronospora, relative efficiency of fungicides 862
  - treatment 759
- *Peronospora schachtii* on beets 759
  - *viticola*. (*See* Grape downy mildew.)

Page.

- **Persimmon thrips, notes** 561
- **Persimmons, analyses, Tenn** 149
  - culture 1048
  - improvement 52, 650
  - Japanese, as affected by unusual cold, Ala. College 1041
    - culture 1048
    - notes, S. C 1047
      - Tenn 148
      - U. S. D. A 939
- Peruvian guano industry 917
- Perymenium, revision of genus 121
- *Pestalozzia funerea*, notes 949
  - *gulpini*, notes 948
- Petroleum, crude, as an insecticide, N. J 868
  - preparation and use, N. J 868
  - ether for determination of milk fat 213
  - motors 598
- Phænogams, oxidizing ferments in 715
- Phagocytes, relation to immunity 794
- Phagocytosis, tubercle bacillus 193
- Phalacridæ, monograph 562
- Phanerogams of South Dakota 817
  - parasitic of Great Britain 909
  - protein synthesis in 1015
- Pharmaceutical analysis, error 310
- *Phaseolus multiflorus*, abnormal swelling of roots 1061
  - *vulgaris*, new evidence of American origin 250
- Phasmidæ of New Zealand, notes 766
- Phenacetolin as an indicator 311
- Phenol, germicide power 697
- Phenological observations in Austria 223
- Phenylhydrazin test of sugar 705
- Philippine Islands, plant products, U. S. D. A 497
  - trade, U. S. D. A 198
- *Phlegethontius celeus*, notes, U. S. D. A 952
- *Phleum alpinum scribnerianum*, n. var., notes 319
- Phlœothrips, new species 476
  - of olives, remedies 474
- *Phlœothrips oleæ*, anatomy and biology 474
  - notes 474
- Phlox disease, notes 167
  - treatment, N. J 752
- Phloxes of western North America, revision, Wyo 1015
- *Phlyctinus callolus*, notes 760
- *Phoma betæ*, notes 163
  - on beets 166, 468
  - *flaccida*, parasitic nature 1061
  - *pithya*, notes 262
  - *reniformis*, parasitic nature 1061
    - rôle in grape black rot 1061
  - *sordida* affecting *Carpinus betulus* 1061
  - *uvicola*, rôle in grape black rot 1061
- Phosphate, Belgian, analyses, R. I 917
  - deposits in Japan 723
  - from Fernando Noronha, analyses 723
  - mineral, analyses, R. I 917
  - of potash, analyses, Conn. State 719
- **Phosphate trade in the United States** 723
  - **Wiborgh** 230, 331
- **Phosphates, acid, analyses, Tex** 438
  - **comparative effectiveness on white mustard** 436
  - **consumption in production of cereals** 529
  - **crude, utilization by various plants, Me** 913
  - **determining relative value** 1004
  - **for hops** 340
  - **insoluble residue** 107
  - **mineral, analyses, Tex** 438
    - **availability of phosphoric acid in** 527
    - **methods of analysis** 903
  - **of Gard** 331
    - **soil as affected by acid solutions** 131
    - **the Pyrenees** 723
  - **studies** 529
  - **world's production** 528
- **Phosphatic deposits, analyses** 230
  - **fertilizers, effect on lodging of grain** 44
    - **for sugar beets** 39
    - **studies** 229
  - **rock, analyses, La** 39
    - **Ky** 314
  - **slag, analyses, Can** 831
    - **La** 39
    - **basis of selling price** 529
    - **citrate solubility** 109, 157, 505
    - **for marshy soil** 39
    - **production and consumption in Europe** 917
    - **sifting for analysis** 505
    - **solubility in citric-acid solutions** 109
    - **studies** 419
    - **valuation** 34
    - **vs. redondite as a fertilizer, N. H** 136
- Phosphoric acid—
  - citrate soluble 505, 813
  - comparison of forms, Del 141
  - content of soil 228, 822
  - determination 105, 107, 108, 112, 505, 507, 508
  - effect on cereals 529
  - excretion as affected by castration 483
  - in agriculture 1025
    - mineral phosphates, availability 527
  - of soil water, studies 821
  - physiological role, U. S. D. A 1008
  - solubility in surface and subsoils 822
- Phosphorus compounds in egg yolk 882
  - content of muscular tissue as affected by work 778
  - determination 1007, 1100
  - effect on formation of fat 1076
  - in organic substances, determination 213, 1007
- Photosynthesis and plant coloration 1011
  - by light which has passed through leaves 1010
  - in evergreen leaves in winter 910

Page.
Phototherapy as a disinfectant 293
Phoxopteris comptana, notes, Mich 954
N. J 761
Phragmidium subcorticum, notes 360
Phryganidia californica, notes 564
Phthirius, notes 263
Phylacteophaga eucalypti, n. sp. on *Eucalyptus globulus* 564
Phyllospora comosa, notes 229
Phyllosticta cucurbitacearum, notes, Ohio 357
sphæropsoidea, attacking chestnuts, N. J 753
violæ, notes 261
Phyllotocus macleayi robbing beehives 561
Phyllotreta nemorum, notes 562, 657
Phylloxera, effect on grape roots 262
in Austria 657
Italy 477
New South Wales 477
Switzerland 763
notes 173, 273
treatment .. 175, 371, 463, 658, 959, 1057
Phylloxera quercus, notes 657
vastatrix, notes 959
Phylogeny of bacteria 125
Phymateus punctatus, notes 477
Phymatodes variabilis, notes 764
Physical-chemical laboratory, University of Giesen 619
Physics and meteorology in universities, U. S. D. A 430
Physiological and pathological chemistry, text-book 212
constants, study, Vt 315
Physiology, animal, as related to agriculture 482
of alcoholic ferments 125
plants, relation to other sciences 121
tree trunks 121
Physoderma leproides, notes 361
Physopus atrata affecting peas 1066
robusta affecting peas 1066
Phytocoris militaris, notes 174
Phytodecta, estivation 656
Phytonomus nigrirostris, notes 561
punctatus, notes 561
Phytophthora infestans. (*See* Potato blight and Potato rot.)
omnivora affecting cacao 1061
notes 362
Phytoptus, histological modification 911
Phytoptus ribis, notes 272
taxi, notes 766
Phytosterin, occurrence in the animal body. 672
Picea excelsa, notes 121
seeds, constituents and cleavage products of proteids 111
pungens, notes, Can 855
Pickle worm, notes, Ga 864
U. S. D. A 863
Pieris brassicæ, inoculation experiments 1064
remedies 1063
protodice. (*See* Cabbage butterfly.)
rapæ. (*See* Cabbage butterfly, imported.)
Pig diseases, manual 93

Page.
Pig manure, analyses, Ky 314
raising in the South 881, 497
Pigs, alfalfa hay for, U. S. D. A 397
artificial milk for 983
breeding experiments 1077
chronic cough 797
cost of fattening, S. Dak 878
erysipelas, treatment 290
fattening on alfalfa hay, Kans 498
Kafir corn, Kans 498
feeding experiments 68, 71, 483, 674
Can 968
Fla 876
Ind 667
Kans 182, 377
Mass. Hatch 568
Minn 175
Miss 1072
N. H 967
Okla 1069
S. Dak 878
W. Va 774
foot-and-mouth disease in 695
growth as affected by composition of milk 576
infectious pneumoenteritis 290
Jerusalem artichokes for, U. S. D. A 296
metabolism experiments 672
pure-bred, feeding experiments, Can 668
rape vs. clover for, Wis 570
silage for, U. S. D. A 599
skim milk for 490
slaughter experiments 483
stomach parasites 697
Pigweed, notes, Okla 354
Pimpla conquisitor, relation to *Clisiocampa americana* 1100
Pine aphis, notes 582
bark beetle, notes, W. Va 475
bibliography of insects affecting, W. Va 475
Japanese, wart disease 469, 861
lands, cut over, value for agriculture 941
leaf cast, treatment 1061
Riga, as wind-breaks 550
sawfly, notes 272, 562
seeds, destruction by *Gastropacha quercus* 371
short leaved, new disease, S. C 1061
southern, studies 1050
wood structure 1050
weevil, small brown, notes 168
white, analyses, Idaho 314
diseases, U. S. D. A 746
geographical distribution, U. S. D. A 746
insect enemies, U. S. D. A 746
lumber industry, U. S. D. A 746
physical properties of wood, U. S. D. A 746
yellow, analyses, Idaho 314
Pineapple culture in Florida and Cuba 650
disease, notes 256
Pineapples, fertilizer experiments 448
Fla 789
fertilizers for 744

Page.
Pineapples, forcing 352
frost resistance as affected by fertilizers, Fla 739
insects affecting 1065
and diseases affecting, Fla 741
soils for 448
Pinetum at Wellesley 747
Pinks, diseases, treatment, N. J 752
Pinus laricio, oogenesis 28
strobus, bladder rust 949
monograph, U. S. D. A 746
sylvestris, witches' broom 469
Pionea rimosalis, notes, U. S. D. A 952
Pisciculture in Germany 484
Pissodes notatus, notes 168
Pithyophthorus minutissimus, notes.. 764
Plane trees, disease 861
Plant analysis, error 310
anatomy from standpoint of classification 121
and agricultural chemistry 617
breeding as experiment station work. 202
by bud selection 1047
notes 1099
studies, U. S. D. A 463
bug, banded leaf footed, notes, U. S. D. A 364
northern leaf footed, notes, U. S. D. A 364
tarnished, notes, Mo............ 367
diseases as affected by medium of growth 550
related to weather, Conn. State 758
caused by animals 262
bacteria 555
due to nematodes 167
in Holland 562
Italy 948
text-book 555
winter treatment 167
evolution, treatise 318
food in tablet form, analyses, Mass. Hatch 138, 528
loss in cultivated soils 134
galls, studies 167
growth and climate in Argentina 821
as affected by cold vs. warm water, Wis . 540
electricity, Mass. Hatch 552
solar radiation 907
studies 221
histology, methods 29
individualism 249
lice affecting sugar beets 1057
fungus disease 564
notes 173, 657
N. Dak 264
of sugar cane, notes 66
nutrition as affected by grafting 344
parasites of poultry 495
treatment by intra-organic injections 656

Page.
Plant pathology, twenty years of progress.. 1099
physiology, apparatus 28
relation to other sciences. 121
products of the Philippine Islands, U. S. D. A 497
relations, text-book 709
respiration as affected by changes in temperature 421
roots as affected by distilled water... 321
structure as affected by water and soils 515
structures, text-book 909
swellings, notes 910
tissues, coloration as affected by the spectrum 907
wounds, healing 116
Plantago major, analyses, Mo 1008
Plantain, analyses, Mo 1008
long-leaved, eradication, Wis..... 749
Plantains, notes, Vt 854
Plants, absorbtion of solutions through stems 815
acclimatization 242, 296, 816, 1015
apparatus for registering growth .. 911
as affected by acid gases 710
alkali, U. S. D. A 397
electricity..... 25, 552, 1016
fog 1016
hydrocyanic-acid gas 1009
potassium perchlorate 331
Roentgen rays 321
salt and sea water ... 24
sunlight and shade .. 420
toxins 122
zinc in soil 328
assimilation of carbohydrates 317
mineral elements. 121, 216
nitrates 221
organic nitrogen ... 316
soil chlorin 132
soluble salts 1009
autumn coloring 113
bacterial rots 259, 468
bud variation 424
causes of variation 425
closing stomata at night 115
cold vs. warm water for, U. S. D. A .. 296
color as affected by photosynthesis 1011
copper content..... .... 24, 1012
cultivated, effects of selection on .. 3
principal fungus diseases 59
dwarfing experiments 548, 910
fertilizing with liquid manures 242
for alkali soils, U. S. D. A 397
alpine gardens and rockeries ... 52
rabbit-infested country of South Queensland 220
form and characters as affected by fungi 121
hardy, spontaneous hybrid 249
introductions, U. S. D. A 319
improvement by selection, U. S. D. A. 423
incinerating apparatus 506
maritime, structure as affected by external agents 321

Page.
Plants, metabolism of protein 331
methods of improvement 442
occurrence of barium in 619
red cell sap in 121
of Columbia, Mo., ecology, Mo 1015
overfeeding, Mass. Hatch 553
perfume-yielding 458
physiological importance of furfuroids 121
nature of acclimatization 816
poisonous, of western Australia 220
to live stock 120, 220
N. J 113
U. S. D. A 909
man, N. J 112
producing poisonous honey 271
propagation, W. Va 251
protection against fungi 555
resistance to disease as affected by medium 550
rôle of alkaloids 317
sodium 513
rosaceous, leaf spot 759
submerged, effect of various substances on respiration and assimilation 320
sulphur content 723
temperature 315
transpiration 118, 221, 908
utilization of crude phosphates, Me. 913
woody, anatomy of hypocotyl and epicotyl 28
study of seedlings 28
Plasmodiophora californica, notes 466
vitis, notes 466
Plasmodium, life history 658
Plasmopara cubensis, host plants 57
notes, Ohio 357
viticola. (*See* Grape downy mildew.)
vitis, notes 260
Plaster, analyses, Conn. State 719
and muck, analyses, Mass. Hatch 1026
for clover 230
Plat experiments, factors tending to vitiate results 1036
Platinum, catalysis 706
Pleurococcus vulgaris on greenhouse plants 906
Pleuro-pneumonia, acute fibrinous 796
contagious, of horses, immunization 1092
outbreak in New Zealand 995
epizootic, notes 894
etiology 1091
notes, U. S. D. A 995
of horses, serum treatment 594
preventive inoculation 696
treatment 796
Plow, steam, in Finland 97
Plowing, fall 540

Page.
Plowing under stubble for diseases of cereals 175
with a steam plow 540
Plowrightia morbosa, notes, Colo 246
Plows, French subsoil 526
Plum black knot, notes, Colo 246
blight, notes, Colo 246
culture in England 937
curculio, notes 66, 955
Can 863
Ga 173
Wash 1064
gouger, notes, Wash 1064
leaf beetle, notes, U. S. D. A 366
pockets, notes, Colo 246
powdery mildew, notes, Colo 246
rosette, notes 369
sand, Kans 498
tree aphis, remedies, Wash 1064
trees affected by *Xyleborus dispar*, Conn. State 762
attacked by Scolytid beetles 871
treatment for lichens, Vt 321
Plums as affected by unusual cold, Ala. College 1041
blossoming season, Colo 245
Vt 348
bud development 851
cross pollination, U. S. D. A 599
forcing 352
hardiness, Vt 347
hardy stocks for 931
hybrid, studies 352
Vt 47
Japanese, shot-hole effect, N. Y. Cornell 165
variation in same variety 937
varieties, Mich 50
N. Y. Cornell 1045
limits of crossing, Vt 48
notes, S. C 1047
parasitic diseases 949
pollination, Vt 347
propagation 1048
relative hardiness of groups, Wis 930
root pruning, Del 845
Russian, tests, Iowa 647
self fertility, Colo 246
sterility, method of testing, Vt 347
shot-hole effect 757
varieties 851
Can 844, 850
Colo 246
Mass. Hatch 544
Mich 153, 252
Mont 251, 1048
N. H 152
Okla 929, 1036
Wayland group, Vt 351
Plusia brassicæ, notes, U. S. D. A 472, 952
remedies 1065
Plutella cruciferarum, notes 765
U. S. D. A 952
maculata affecting cauliflower 1063
Pneumoenteritis, infectious, of the pig 290

Page.

- Pneumonia, epizootic, prevention 894
  - infectious, notes 794
  - notes 793
  - of horses, treatment 394
- *Poa acutiglumis*, n. sp., notes, U. S. D. A 28
  - *brevipaniculata*, n. sp., notes, U. S. D. A. 28
  - *capillarifolia*, n. sp., notes, U. S. D. A .. 28
  - *curtifolia*, n. sp., notes 709
  - *epilis*, n. sp., notes, U. S. D. A 28
  - *fendleriana* and its allies, U. S. D. A ... 23
  - *incurva*, n. sp., notes, U. S. D. A 28
  - *invaginata*, n. sp., notes, U. S. D. A 28
  - *leckenbyi*, notes, U. S. D. A 423
    - n. sp., notes, U. S. D. A 28
  - *limosa*, n. sp., notes, U. S. D. A 28
  - *longiligula*, n. sp., notes, U. S. D. A 28
  - *macrantha*, notes, U. S. D. A 423
  - *planifolia*, n. sp., notes, U. S. D. A 28
  - *pratensis*. (*See* Kentucky blue grass.)
  - *saxatilis*, n. sp., notes, U. S. D. A 28
  - *tenerrima*, n. sp., notes, U. S. D. A 28
  - *wyomingensis*, n. sp., notes 319
- *Podosphæra oxyacanthæ*, notes, Colo 246
- *Pœcilocapsus lineatus*, notes, Can 863
- *Pœcilocystus diffusus*, notes, U. S. D. A 472
- Poisoning by water hemlock, N. Dak 287
  - wild cherry leaves, U. S. D. A. 599
- Polariscope, correction of readings for temperature 311
  - "quartz scale," new 420
- Polarization apparatus, new 214
- Polled Durham cattle, notes, U. S. D. A 983
- Pollen, biology 319
- Pollination of corn 706
  - Cucurbita 220
  - flowers, Me 909
  - muskmelons 707
  - plums, Vt 347
  - pomaceous fruits, U. S. D. A. 447
- *Polycarpœa spirostylus*, copper content 1012
- *Polychrosis botrana*, notes 367
- *Polygonum sachalinense*, notes, N. C 1032
- *Polygraphus rufipennis*, notes 764
- Polymorphism of bacteria 125
- *Polyporus ulmarius*, notes 467
- Pomological Society, American—
  - fruit catalogue, U. S. D. A 544
  - meeting 398
- Ponds in landscape gardening 650
- Poplar canker, notes 59
  - leaves as a feeding stuff 576
  - Russian, notes 852, 853, 855
    - Can 853
- *Populus angustifolia*, notes, Mont 1051
  - *balsamifera*, notes, Mont 1051
  - *bereolensis*, notes, Can 852, 853
  - *deltoides*, notes, Can 853
  - *petrowskiana*, notes, Can 855
- Pork production, cost, Mass. Hatch 569
- *Porphyrophora polonica*, notes 958
- *Porthesia auriflua*, notes 766, 870
  - *chrysorrhœa* disease 67
- *Porthetria dispar*, life habits 767
- Porto Rico—
  - agricultural conditions 536
    - U. S. D. A 497

Page.

- Porto Rico—Continued.
  - climate, U. S. D. A 30
- *Portulaca oleracea*, analyses, Mo 1006
  - studies 1068
- Post-graduate study at Washington 699
- Potash and bone, analyses, Conn. State 719
  - bulb, new form 813
  - determination 109, 417, 567
  - for black rust of cotton, Ala. College 139
  - industry, future 230
  - requirements of barley as affected by various factors 531
  - vs. soda in plants 85
- Potassium cyanid as an insecticide 174
  - iodid treatment for milk fever .. 598
  - nitrate, determination of nitrogen 705
  - perchlorate, effect on plants 331
  - permanganate and copper as a fungicide 166
    - for determining availability of organic nitrogen, N. J 721
  - sulphid for gooseberry mildew, N. Y. State 946
    - preparation and use, Me 262
- Potato bacillus as cause of "sticky" bread, Wis 565
  - beetle, Colorado, natural enemy 767
    - notes 273
    - notes 957
  - blight. (*See also* Potato rot.)
    - notes, N. H 255
    - treatment, Vt 355
  - brown rot, notes, U. S. D. A 260
  - disease, epidemic in Finland 59
    - new 861, 1061
  - diseases, notes 1057
    - résumé, Vt 861
    - treatment 168
  - flea-beetle, notes 273
  - harvesting machines, tests 540
  - late rot, notes, U. S. D. A 260
  - leaf blight, notes, U. S. D. A 260
  - rot. (*See* also Potato blight.)
    - notes 255, 1057
    - prevention 59, 255
  - scab, development as affected by fertilizers, N. H 256
    - notes 1057
      - Kans 498
      - N. H 255
      - N. Y. Cornell 168
      - U. S. D. A 260
      - Vt 356
    - treatment, Del 468
      - Ind 356
      - Iowa 651
      - Ky 260
      - Mich 250
      - N. Dak 361
      - N. J 751
  - scald, notes, U. S. D. A 260
  - stalk weevil, notes, Kans 498
    - remedies, Kans 171

Page.
Potato starch as an adulterant of flour 482
  tip burn, notes, Vt 355
  tubers, value of different parts for planting, N. J 751
  yellow blight, notes 948
Potatoes, adhesive copper fungicides for. 1061, 1062
  analyses 249
  atavism 710
  bacterial diseases 260, 468, 556
  bacteriosis 464
  breeding 144
  chemical changes due to freezing. 576
  culture 241, 340, 1038
    Can 642
    U. S. D. A 296
    experiments, Can 630
      Md 440
      S. C 1047
    in France 44
  double cropping with cabbage 44
  ensiling 1038
  extra-early, culture, Kans 535
  fertilizer experiments . 241, 332, 337, 340, 640, 733, 834, 842, 1027, 1028, 1038
    Ark 926
    Can 833
    Mass. Hatch .. 543
    N. J 440
    N. Y. State. 235
  growth as affected by water and soil nutrients 927
  hollow 44
  irrigation experiments, Wis 538
  large vs. small for seed 1038
  method for securing early 145
  methods of storing to prevent rot. 59
  nutritive value 73
  planting at different distances 44
  quality as affected by different fertilizers, Va 838
  root system, N. Dak 215
  rotation experiments 842
  sclerotia diseases 469, 948
  second crop, for seed, U. S. D. A . 296
  seed selection 1038
    Mass. Hatch 529
  spraying experiments, Md 441
  starch content as related to diseases 255
  unidentified disease, Nebr 314
  varieties .. 146, 337, 441, 442, 733, 842, 1038
    Ariz 834
    Can 630
    Mass. Hatch 531
    Md 440
    Mich 250
    Miss 241
    N. Dak 332
    N. H 235
    R. I 924
  vs. roots for lambs, Minn 181
Poultry, animal matter for, U. S. D. A 397
  associations of Ontario, reports .. 577

Page.
Poultry breeds and American standards of prefection 80
  comparison of crosses and breeds, N. C 1073
  culture 972
    cooperative 484
  department of New Zealand, report 883
  diseases, manual 697
    notes 291
  feeding experiments, N. Y. State .. 76
    in Jamaica . 577
    Réunion . 577
  fleas, destruction 697
  gapeworms, notes 495
    remedies 191, 392
  house, description, N. Y. State 295
    floored vs unfloored, W. Va. 776
    portable 779
  industry in Russia 484
  lice, treatment 561
  manual 80
  manure as a fertilizer 830
  mites, notes 495
  raising in England 577
    requirements, R. I 972
Powder duster for plants 659
Prairie acacia, notes, Okla 354
Pratia erecta, notes 120
Precipitation as affected by forests 718
  effect on elevation of ground-water surface 517
    level of Great Lakes, U. S. D. A. 622
  measurement, U. S. D. A 283
  near the Great Lakes, U. S. D. A 429
  over the Pacific Northwest, U. S. D. A 430
  percentage penetrating the soil 517
Preservation of butter.
  eggs, N. Dak 279
  fruits 453
Preservatives, effect on cider 1100
  for fruit 250, 549
  in canned foods, N. C 960
Preserved foods, manufacture 278
Preserves, analyses, Conn. State 769
Prickly comfrey, N. C 1032
  lettuce, eradication, Wis 749
  pear, analyses 314
    treatment with arsenical sprays 651
Primulas, Chinese, breeding 453
Prison dietaries in Scotland 575
Prodenia littoralis, notes 563
Prosopis dulcis, analyses 458
Protargol for conjunctivitis and fistula 496
Proteid bodies, changes in physical state .. 705
  formation in plants as affected by light 707
  materials in circulatory system 778
Proteids as affected by formaldehyde. 125, 511, 715
  of nitrogen 510
Protein bodies, definite compounds 310

Page.

Protein cleavage as affected by sodium chlorate 488
of carbohydrates from.... 813
compounds of arginin 511
digestibility, determination........ 418
effect on milk production, Mass. Hatch 577
metabolism in plants 321
preparations, digestibility 184
protection by alcohol 672
reserve, notes 710
synthesis in phanerogams 1015
Proteolytic enzym of Nepenthes.......... 124
Proteoses, determination in peptic digestion 971
Proteosoma, life history.......... 658
Protococcus botryoides on greenhouse plants. 906
Protoparce carolina, treatment, U. S. D. A.. 471
celeus, notes 871
treatment, U. S. D. A..... 471
Protoplasm as affected by anesthetics...... 118
gases.......... 120
Provender, analyses, Conn. State 279
Prune brown rot, notes 371
Oreg.......... 466
Prunes, culture and preparation for market, Wash.......... 1045
dipping, Oreg.......... 446
evaporation 851
for pigs, Wash.......... 1046
insects affecting, Wash 1064
varieties, Mont 251, 1048
Pruning book 152
general principles, U. S. D. A 451
shrubs.......... 50
summer.......... 650
Psalliota, n. sp., notes 709
Pseudocommis vitis, notes 59, 406
Pseudomonas stewarti, notes, N. J 751
Pseudotsuga douglassi, notes 747
Psila rosæ, notes, Can 863
remedies 559
Psittacosis, notes 793
Psoroptes communis, notes 895
Psylla pyricola, notes, U. S. D. A 952
Psyllidæ, notes.......... 476
Pteromis ribesii, notes, U. S. D. A.......... 952
Pterophorus monodactylus, notes, Md....... 62
Public domain of the United States, U. S. D. A.......... 497
schools, meteorological observations at, U. S. D. A 819
of New York City, instruction in cooking, U. S. D. A. 79
Puccinellia simplex, n sp., notes.......... 709
Puccinia ægopodii, notes 468
agrostidis, notes 468
asparagi, notes, Mass. Hatch 159
S. C 160
Vt 356
cari-bistortæ, notes 360
coronata, notes, U. S. D. A 943
crandallii, n. sp., notes.......... 361
dioicæ, notes.......... 468
dispersa, sources of origin 554
glumarum, notes 259
Puccinia graminis avenæ, notes, U. S. D. A. 943
secalis, notes, U. S. D. A. 943
tritici, notes, U. S. D. A . 943
hieracii, notes, N. J 947
liliacearum, cytology of teleutospores 1015
moliniæ, notes.......... 360
orchidearum phalaridis, notes 360
polygoni, notes.......... 360
rubigo-vera tritici, notes, U. S. D. A.......... 463, 943
secalis, notes, U. S. D. A.......... 943
smilacearum digraphidis, notes... 360
sorghi, notes, U. S. D. A 943
triticina, sources of origin 554
Puccinias on Compositæ 949
Pulicidæ, systematic position 173
Pullets, early vs. late hatched, Utah........ 480
vs. hens for egg production, Utah.. 480
Pulvinaria camellicola, studies.......... 1066
innumerabilis, notes, Iowa 958
Pumpkins, analyses.......... 249
cooked vs. uncooked, for pigs, N. H.......... 967
for cows.......... 1081
varieties, Ala. Canebrake....... 251
Can 631
S. Dak 51
Pumps, insecticide, tests 172
tests.......... 197
Purdue University, notes 800, 1097
Pure cultures for Cheddar cheese making.. 283
cheese making, U. S. D. A. 296
in wine making. 126
preparation and use......... 87, 714
food law, Conn. State.......... 769
Purplish-red borer, notes.......... 564
Purslane, analyses, Mo.......... 1008
notes, Okla 354
sawfly, notes.......... 871
shading, N. J.......... 739
studies, Mo.......... 1068
Putnam scale, notes, Ind.......... 657
Pyralidæ, notes 767
Pyrethrum, preparation and use, Mass. Hatch 174
Pyromorphite, analyses 230
Pyrosoma bigeminum, notes, U. S. D. A..... 985
Pyrrhocoris apterus, study.......... 657
Pyrus baccata as a stock.......... 451
for apples, Can.... 850
S. Dak 848
varieties, S. Dak.......... 848
prunifolia as a stock for apples, Can. 850
varieties, S. Dak.......... 848
Pythium debaryanum, notes.......... 163, 757
Quack grass, eradication, Wis.......... 749
Quarantine, compulsory, for animals....... 591
laws for live stock, suggestions 91
Quassia chips for orchid bug.......... 174
Quassia gabonensis, copper content......... 1012
Queensland fruit fly, notes.......... 563
Quercus pedunculata, varieties.......... 855
suber, notes 747
Quince borer, notes.......... 760
curculio, notes.......... 173

Page.
Quince leaf spot, notes, Ky 170
pectin 906
pollination experiments, U. S. D. A. 447
sclerotium disease 949
trees, pruning 548
Quinces, bud development 851
varieties 251
Can 547
Rabbit plague near Stuttgart 428
Rabbits, destruction with chicken cholera bacillus 1087
epizooty 712
feeding experiments 275
metabolism experiments 381, 576, 778
notes, U. S. D. A 426
remedies 372, 428, 659
Rabid animals, antitoxin in bile 1092
Rabies and distemper, differentiation 896
differential diagnosis, U. S. D. A 985
in cattle 291, 1091
England, control 191
Massachusetts 501, 1087
New York 492
inocculation for diagnostic purposes. 1092
notes 793, 995
Del 189
Nebr 393
U S. D. A 995
virus, intracerebral inoculation 697
Radish seed, small vs. large, Me 928
Radishes, notes, Ariz 850
subwatering, Me 929
varieties, Mich 250
S. Dak 51
Raffinose, fermentation by *Saccharomyces pombe* 715
Ragi tailings as food 575
Ragweed, notes, Vt 354
Railroad ties, preservation 1052
Railways, metal ties for 1050
Rain and snow gauge, Marvin's, U. S. D. A. 127
soil, effect on forage plants 32
gauge and the wind, U S D. A 819
readings at Atlanta, U. S. D. A. 819
producing processes, U. S D. A 126
Rainfall and rivers in Idaho, U. S. D. A 819
area at high stations, U. S. D. A .. 430
as affected by forest clearing and cultivation, U. S. D A 127
sunspots 31
catch as affected by wind, U. S. D. A 620, 818
in agricultural meteorology, U. S. D. A 127
Barbados 840
California, U. S. D. A 621
Nicaragua, U. S D. A 430
Texas, U. S. D. A 430
notes 819
reports, telegraphing to section centers, U. S. D. A 127
Rains, warm, and angleworms, U. S. D. A ... 819
Raisins, analyses 882
Ramie, culture 220, 340
in Mexico 1038

Page.
Rape, analyses, Minn 868
as a forage crop, U. S. D. A 340
culture experiments, Can 632
S. Dak 43
digestibility, N. C 277
fertilizer experiments, Can 632
for fattening pigs, Can 669
notes, Can 833
N. Dak 339
seed cakes, mustard oil in 22, 619
poisonous to cattle 92
fat content as affected by soil and fertilization 141
meal, analyses, Conn. State 719
varieties, Can 631
vs. clover for pigs, Wis 570
Raspberries, black, analyses 1046
varieties 650
Can 644
bud development 851
culture experiments, N. J 735
fertilizer experiments 1039
N. J ... 735
irrigation experiments 1039
N. J ... 735
preservatives for exhibition purposes, Can 649
purple, analyses 1046
red, analyses 1046
hardiness of varieties, Wis 930
varieties 650
Can 644
Mass. Hatch 544
Mich 252
varieties, Can 850
Mich 153, 252
Okla 929
Wis 150
Raspberry anthracnose, notes, Ky 170
cane borer, remedies, Ohio 63
leaf spot, notes, Colo 314
moth, remedies 264
sawfly, remedies, N. Y. State 63
weevil, remedies 264
Rat-destroying bacillus, biology 393
diseases, pathological anatomy ... 393
Rations, balanced, Kans 498
calculation 184
medium vs. wide, relative feeding values, Vt 382
of nearly equal balance, feeding value, Vt 382
winter, for cows 284
Razoumofskya robusta, seed dissemination 28
Recording instruments, storage battery for, U. S. D. A 620
Red clay, Piedmont, improvement, N. C 497
clover. (*See* Clover, red)
Poll cattle, notes, U. S. D. A 983
spider, notes, Wash 1064
remedies 172, 174, 1065
Ohio 473
water, inoculation against 593, 796
prevention 289
studies 192, 995

Page.
Redbud, Japanese, diseases, treatment, N. J. 752
Redfieldia flexuosa, notes, U. S. D. A. 423
Redfield's grass, notes, U. S. D. A. 423
Redondite vs. Thomas slag as a fertilizer. 136
Redtop, analyses, Conn. Storrs 882
notes, N. Dak 339
Redwood, notes 456
Reforestation in Colorado 53
the Southwest 458
Refractometer for examination of butter 618
Refrigerating machines, tests 97
Refrigeration in dairying 87
Reichert number of butter 679
Reindeer, epizootic disease 895
meat, measles in 91
milk butter, analyses 789
Rennet, action as affected by salt, Wis 584
in watered milk, Wis 581
effect of different quantities, Can 685
extract, effect in curdling milk, Wis. 580
Reseda odorata, notes 465
Reservoir irrigation on the plains 597
survey 798
Reservoirs in irrigated regions 294
storage 195
Resins, analysis methods, handbook 1008
Resorcin as an indicator 214
Respiration calorimeter, development 501
experiments 110
new 372, 576
experiments with animals 80
of plants as affected by temperature 515
of plants as affected by various substances 320
Respiratory quotient as affected by muscular work 72
Respired air, method of measuring 971
Retting of flax 240
Rhagoletis cingulata, notes, N. Y. Cornell 866
Rhamnus lanceolata, hosts, U. S. D. A 943
Rhizobius jujubæ, notes 957
ventralis, importation in California 558
Rhizoctonia betæ, notes, N. Y. Cornell 162
subepigea, n. sp 261
violaceæ affecting sugar beets 163, 1057
Rhizoctonia producing plant diseases 57
Rhizomes, causes of downward growth 320
Rhode Island College, notes 298
Station, financial statement 998
notes 699
Rhododendron ferrugineum, notes 271
hirsutum, notes 271
Rhopalosiphum dianthi affecting brinjal 1063
remedies 1065
violæ, n. sp., notes 871
Rhopobota vacciniana, remedies, U. S. D. A. 951
Rhubarb, forcing 51, 649, 999
R. I 645
Rhynchites betuleti, notes 273, 1057
Rhyssa persuasoria, notes 168
Rhytisma acerinum, notes, Mass. Hatch 552
Rib grass, notes, Can 651
Rice affected by phlœothrips 476
as an adulterant of flour 482

Page.
Rice blast, notes, S. C 463
blight, notes, S. C
bran vs. wheat bran for cows, N. C 1078
corn, black, analyses, Okla 277
culture in Cambodia 1038
Louisiana 1038
industry in the United States 898
meal, analyses, N. J 777
monograph on 1038
smut, treatment, S. C 464
stalk borer as cause of blast, S. C 463
wild, analyses, Minn 883
Ricin as a vaccine 287
effect on tissues 91
toxicology 496
Ricinus seeds, studies 287
"Rickets," cause 1087
in cattle produced by macrozamia roots 894
Rinderpest, treatment 88, 91, 192, 494, 593
Ringing grapevines, N. Y. State 49
roses 151
River and flood service, U. S. D. A. 126, 223
discharges in Colorado, U. S. D. A. 620
gauge, new, U. S. D. A 818
stations, data for 1898 1094
notes 196
Rivers of Ohio as sources of public water supply 197
United States, measurements of water, U. S. D. A 31
Road building, principles, U. S. D. A 395
State aid in Minnesota, U. S. D. A 396
improvement in governors' messages, U. S. D. A 396
making instructor in Ontario, report. 294
metals 799
Roads, administration 799
country, construction and maintenance, Wis 1095
improvements, Wash 1094
good, advantages 799
construction, U. S. D. A 498
macadamized, construction and maintenance 598
sprinkling with oil 197
Rock gardens, treatment 650
phosphate, analyses, Conn. State 719
Rockeries, plants for 52
Rocks, water content 517
Rocky Mountains, water supply 912
Rodolia iceryæ, notes 477
Roentgen rays, effect on plants 321
in veterinary practice 592, 893
Root crops, diseases 556
fertilizer experiments 230, 842
Can 631
rotation experiments 842
subsoiling, Wyo 1026
growth, effect of medium 28
resumption in spring, Wis 511
killing, notes 252
of apple trees, S. Dak 848
nursery stock 244
pressure, cause 424

Page.
Root pruning apple trees 152
as frost protection 153
close, notes 1047
fruit trees, Del 845
summary of experiments 599, 650
suckers among conifers 940
tubercles, number as affected by inoculation, N. J 753
of legumes, bacteria 218
on spring and fall-grown legumes 25
parasitic nature of bacteria 25, 711
physiological processes within 1013
studies 25, 711
Roots, absorption of nutrient substances 320
aerial, functions 710
of grape 28
as affected by static electricity 907
development as affected by concentration of soil solutions 623
fertilizer requirements 250
for cows 284
pigs 68
preparation of seed beds for, Can 642
structure of cork tissues 818
vs. potatoes for lambs, Minn 181
Rosaceæ, cultivated, fungus parasites 166
Rose beetle, remedies, N. H 169
breasted grosbeak, notes 428
chafer, notes 955
N. H 169
U. S. D. A 952
culture in Oregon 450
leaf beetle, notes, U. S. D. A 366
leaves, bronzing, Mass. Hatch 553
Maréchal Niel 154
pests, extermination 477
scale, notes, Conn. State 762
soils, analyses 625
stocks, notes 151
Roses, abnormal growths 556
culture experiments, Conn. State 745
Oreg 450
for grouping 154
grafted, for forcing 151
vs. own root 52
greenhouse, investigations, N. J 750
ringing, for propagation 151
soil vs. climate in culture 454
varieties 154
Rotation experiments 842
in Scotland 1028
Mont 1037
N. Dak 332
summary, Pa 438
with wheat 733
Can 833
Rottlerin in cotton flowers 511
Roup in chickens, serum therapy 594
fowls, differential diagnosis, U. S. D. A 985
treatment 697
R. I 994
Rowen hay, digestibility, Conn. Storrs 874

Page.
Rubber caps for culture tubes, N. J 714
effect of tapping on sap flow and tree 1049
plant for temperate climates 1049
plants, culture 745
production in South America 1049
trees, culture 1049
Rubus phœnicolasius, notes, Wis 150
sorbifolius, notes, Wis 150
Rumenotomy, bovine 289
Rumex acetosella, notes, Nebr 815
hymenosepalus. (*See* Cañaigre.)
salicifolius, notes 28
verticillatus, notes 28
Ruminants, infusoria in stomachs 91, 896
Russian Polish horned cattle, exhibit 778
waters (blister fluid) 496
Rust fungi, duration of winter spores 59
heterœcious, culture experiments 59, 360
Rusts in Switzerland, notes 468
of horticultural plants 758
Ruta-bagas, analyses 71
Rye, after ripening and germination 1054
and crimson clover, analyses, N. J 777
as affected by sodium nitrate 239
an adulterant of flour 482
bran, analyses, Conn. State 279
bread, digestibility 175
vs. wheat bread 183
brown rust, sources of infection 554
chemical changes in molding and sprouting 619, 1036
crop of Hungary, 1899, U. S. D. A 698
culture, Ga 841
effect of temperature on germination 156
fertilizer experiments 540, 782
Del 141
Mass. Hatch 526
grain, composition at different stages of ripeness 636
grains, green vs. yellow, for seeding 1029
grass seed as affected by fertilizers 1029
Italian, viability 158
perennial, viability 158
limit of tolerance of sodium perchlorate 917
monstrosities 540
new species 319
orange leaf rust, notes, U. S. D. A 943
Petkus, origin 1038
spring, varieties, Can 629, 632, 833
straw, extracted, feeding value 771
varieties 442, 538
water absorption of seed 1056
winter, varieties, Can 629
Saccharimeter, standardized 112
Saccharin, detection in foods 312
Saccharomyces ellipsoideus, notes 260
pombe for fermenting raffinose 715
Sachaline, notes, N. C 1032
Sagebrush, analyses, Idaho 314
Sage, white, notes, U. S. D. A 1034
Sainfoin, experiments in seeding 441
Sal coppice forests of Oudh 1052

Page.
Sal forests, improvement fellings 1052
Salad plants, fertilizers 250
Salicylic acid, detection in milk 419, 705
Saliva ferments as affected by borax 962
Salix purpurea, notes 458
    viminalis, notes 458
Salsify, black, white rust 758
    varieties, S. Dak 51
Salsolaceæ, Pacific coast species, Cal 636
Salt and Bordeaux mixture for grape black rot 262
    beds, oceanic formation 704
    common, analyses, R. I 917
    dairy, studies, Wis 585
    effect on bacteria 594
        growth of mold 683
        rennet action, Wis 584
    for eradicating Canada thistle 462
    Lake of Ormi, analyses of waters 434
    marsh hay, experiments, Mass. Hatch . 576
    poisonous effect on plants 24
    water, effect on soil 326
Saltbush, Australian, notes, U. S. D. A 1034
Saltbushes, ash analyses, Cal 638
    culture in California 636
    fodder value, Cal 636
    formation of black alkali 1099
    germination tests, Cal 636
    in New Zealand 842
    notes, U. S. D. A 927
    root systems, Cal 637
    vegetation characteristics, Cal . 636
Saltpeter, effects on animal body 962
Salts, effect on soil moisture 716
    inorganic, effect on conidia formation . 424
    of soil, effect on sugar-cane juice 146
    soluble, absorption by plants 1009
San José scale, allied species in Europe 64
    and the horticulturist 1066
    distribution 274
    in Illinois 654
        Massachusetts 560
        Virginia 66
    larvæ 657
    legislation in Virginia 866
    notes 64, 173, 369, 371, 563, 565, 657, 957, 959
        Can 863
        Ga 173
        Ind 657
        Iowa 958
        Ky 170
        Mich 64
        Nebr 370
        U. S. D. A 952
    on American fruit 655, 958
    origin 173
        U. S. D. A 951
    quarantine regulations 275
    remedies .. 66, 274, 476, 560, 958, 959
        Ala. College 1042
        Conn. State 271, 762
        Del 473
        Idaho 173
        Mass. Hatch 561
        N. J 760, 958
San José scale, remedies, Ohio 367
        Va 566
        Wash 1064
    review of literature 1066
    value of inspector's certificate 173
Sand cherry as a stock 451
    for shade between forest trees . 864
    dunes, drifting, reclamation 435
        of Lake Michigan, ecology 821
    from gold fields, analyses 230
    grains, effect of diameter on flow of water, Wis 525
    grass, notes, U. S. D. A 428
    plum, notes, Kans 498
Sands, shifting, control and fixation 435
Sandy lands, treatment, N. C 497
Sannina exitiosa, notes, Ga 173
        Mo 268
Sap acidity of plants, Minn 1019
    pressure and flow in sugar maple, Vt .. 318
        as related to climate 118
Saperda candida, notes, Mo 268
Saprophytes, effect on mouse-destroying bacteria 393
Sarcocystis, notes 894
Sarcoptes scabiei, bibliography 764
Sarcosporidiasis among buffalo 894
Sausage, adulteration 21
    analyses, Conn. State 769
Sawdust, detection in flour 905
Sawflies, notes 265
    Ohio 63
    remedies, Md 62
Sawmill ashes, analyses, Minn 831
Scale, green, fungus disease 275
    insects affecting tea 1062
        as affected by temperature, U. S. D. A 952
        danger from, in packing material 655
        European, on fruit 657
        found on American fruit 655
        longevity after removing from fruit 655
        notes 760
        position on fruit 655
        remedies 470, 657
        spraying experiments 274
    lice, notes, N. Dak 264
    scurfy, notes 66
        remedies 958
            N. J 958
Schistocerca americana, notes, Mich 954
    paranensis, natural enemies ... 1066
Schistocerca, characters 66
Schizocerus ebenus, notes, Md 62
Schizoneura lanigera, notes 870
        on fruit trees 174
    pinicola, notes, Conn. State 762
    sp., notes 657
School grounds, horticultural decoration, N. Y. Cornell 50
Scientific aids in the U. S. Department of Agriculture 1, 430
    assistants, notes, U. S. D. A 819

Page.
Scion and stock, reciprocal influence . 250, 845, 850
  modification, caused by grafting 344
Sclerospora graminicola affecting millet and foxtail grass, Mich 58
Sclerotinia pæonia, notes 167
Scolytid beetles attacking plum trees 871
Scolytus quadrispinosus, notes 764
  rugulosus, notes 264, 272
    Ga 173
    Mich 954
    Mo 268
    U. S. D. A 366, 952
Screw-worm fly, notes, Miss 272
Sea lyme grass, notes, U. S. D. A 423
  water, poisonous effect on plants 24
Seaweed, analyses 229
  as a fertilizer 527
    mulch for orchard fruits 548
  value and uses, U. S. D. A 599
Secale africanum, n. sp., notes 319
Sediment trap 214
Seed and plant distribution of California .. 1047
  beds, preparation, Can 642
  breeding, Kans 498
  control, catechism 56
    Danish, report 55
    Norwegian, report 56
    station at Gratz, report 157
      of St. Petersburg, report 159
    stations, German, reports .. 55, 1055
      Swedish, reports 55, 56, 156, 354, 460, 750, 1055
      Swiss, report 155
  development, effect on fruit development 932
  dispersal, methods 425
  effect of size on germination 159, 353
  examination apparatus 750
  germination within fruit 355
  industry of England, history 153
  investigation in Bohemia 56
  old, effect of ferments on germination. 460
  production, premature 232
  resistance to high temperatures 855
  testing and selection, methods 462
    apparatus 156
    at Modena, Italy, report 750
    in Germany 462
      Holland 56
      Italy 56
    methods 56
  treatment, Ohio 274
Seeds and plants, foreign, inventory of, U. S. D. A 1015
  chemical processes in germination .. 55
  conditions of germination 1055
  dry or moist, as affected by anesthetics 1056
  germination as affected by—
    alkali, Utah 459
    bed 460
    electricity 355, 462
    enzyms, Vt 354
    low temperature 54
  hygrometric condition 1056
Seeds, imbibition of water from salt solutions, Wyo 1053
  imported by the Section of Seed and Plant Introduction, U. S. D. A 319
  notes on germination 219
  occurrence of cane sugar in 710
    histidin and lysin in. 1056
  oil-bearing, germination 55
    treatise 482
  ratio of perfect abortive forms 818
  testing 1055
  utilization of reserve material 221
  vegetable tests, Conn. State 750
  viability 157
  weed, notes, Nev 158
Seepage waters escaping into larger channels 517
Seiches and mirobia, U. S. D. A 222
Seismograph records, U. S. D. A 430
  stations in the United States, U. S. D. A 620
Selandria vitis, notes, U. S. D. A 952
Selection, effect on cultivated plants 8
  in plant improvement, U. S. D. A 423
Selenipedium lindleyanum, hybrids derived from 549
Selenium for measuring sunshine, U. S. D. A 222
Semasia nigricana, notes 558
  Can 863
  U. S. D. A 471
Senecio præcox, water storage and construction 818
Separators. (*See* Cream separators.)
Septicæmia of guinea pig 291
  parrots 291
  puerperal, of swine, treatment 797
Septoria azaleæ, n. sp., affecting azaleas 759
  graminum, parasitism 948
  lactucæ, notes, N. J 752
  ribis on currants, treatment, Wis. 150
  sp., remedies 959
Sequoia sempervirens, notes 456
Seraphthin, inoculation experiments 696
Serica trociformis affecting hornbeam, Conn. State 762
Sericulture, notes 271
  throughout the world 764
Serum globulin, solubility in water 706
  immunizing, specific action 90
  therapy for hog cholera 290
    tuberculosis 795
  treatment for rinderpest 91
    swine plague and hog cholera, U. S. D. A ... 89
Sesame and cotton-seed oils, differentiation 23
  cake, effect on butter 281
  oil, color reactions 510
    detection 812
    in butter, detection 1007
    reaction, for detection of margarin 888
      reliability 814
Sesamia nonagrioides, notes 564
Sesbania ægyptiaca, analyses 249
Sewage analyses, methods of recording 510
  determination of oxygen content ... 812

Page.

- Sewage disposal in foreign countries 831
  - effect on milk 282
  - irrigation, filtration 1093
- Shade, effect on plants 420
  - trees, decay 1052
    - early dropping of leaves, Mass. Hatch 553
    - for coffee 744
    - in cities 852
      - diseases, Mass. Hatch 553
    - insect enemies 273, 370
    - notes, Okla 1051
- Shaggy mane, notes, N. Y. Cornell 322
- Shavings vs. straw as bedding 97
- Sheep, abortion, barrenness, and fertility, N. J 792
  - beets for 576
  - botfly, notes 263
    - Miss 272
  - bots in head 191
  - breeding experiments 1077
  - caseous broncho-pneumonia 696
  - causes of fertility in, N. J 793
  - commissioners of Montana, report 1092
  - continuous crossing 80
  - corrals, analyses of manure 526
  - digestion experiments, Can 617, 662
    - Conn. Storrs 873
    - Me 965
    - N. C 276
  - dipping, method 191
  - dips, analyses 314
  - disinfectants, analyses 314
  - distribution of galactase in milk, Wis 580
  - enzootic neuritis 93
  - fattening for cold storage 577
  - feeding experiments 773, 779, 1071
    - Minn 179
    - Okla 1069
    - methods 1072
    - on wild plants, U. S. D. A 997
  - foot-and-mouth disease 695
  - for mutton, U. S. D. A 381
  - forage crops for 184
  - growth as affected by composition of milk 576
  - industry of Colorado, U. S. D. A 972
  - injuries to forests and irrigation works 748
  - manual 381
  - manure, analyses, Minn 831
    - value 229
  - metabolism experiments 772
  - multiple adenom formation in lungs 289
  - of Hungary 381
  - pasturing on alfalfa, Colo 378
  - poisoning by deadly nightshade 495
    - *Pratia erecta* 120
  - pox in Montana 1092
    - notes 793
      - U. S. D. A 995
    - prevention 895
    - studies 88
    - wool as source of infection 895
  - scab mite, notes, Colo 370

Page.

- Sheep scab mite, remedies 191
  - notes, U. S. D. A 995
  - quarantine regulations in Montana 1092
  - treatment 593, 895
  - toxic substances produced by intestinal worms 997
- Shooting stars, U. S. D. A 231
- Short-eared owl, feeding habits 428
- Shorthorn cattle, notes, U. S. D. A 983
- Shrub cuttings, season for planting 51
- Shrubs, ornamental, pruning 50, 852
  - varieties 852
  - Russian, tests, Iowa 647
- Silage, analyses 381
  - Conn. Storrs 882
  - Me 971
  - N. J 777
  - digestibility, Mass. Hatch 566
  - for horses, Va 183
    - and pigs, U. S. D. A 599
  - management 576
  - manufacture by stack method 1076
- Silica, function in plants 821
  - standards for determination of turbidity 813
- Silicate of potash, analyses, Conn. State 719
- Silk cocoon fungus, notes 67
- Silkworm cocoons as affected by diminution of heat 65
  - as affected by external conditions 870
  - properties 173
  - eggs, hibernation 870
    - respiratory products during incubation 870
  - growth as affected by the spectrum 908
  - new bacterial disease 870
  - parasite in China 561
- Silo, stave, construction, N. Y. Cornell 294
  - U. S. D. A 599
- *Silpha* spp. affecting sugar beets 1057
- *Silvanus surinamensis*, notes, U. S. D. A 952
- Silver preparation of Credé for diagnosing glanders 495
- "Silver" ware, analyses, Idaho 314
- Simmenthaler cattle, notes, U. S. D. A 983
- *Simondsia paradoxa*, notes 697
- *Simulium pecuarum*, notes, Miss 272
- *Sinapis arvensis*, notes 461
- *Siphonophora avenæ*, notes 765
  - Mont 266
  - *cerealis*, notes 765
  - *granaria*, notes 765
- *Sirex gigas*, notes 168, 562
  - *juvencus*, notes 168
- Sirup, analyses 510, 705
  - Conn. State 770
  - Minn 883
  - determination of water 905
  - making experiments, Ala. College 292
- Sitamon, notes, U. S. D. A 423
- *Sitodrepa panicea*, notes, U. S. D. A 472
- *Sitotroga cerealella*, remedies 871
- Skim milk, analyses, Minn 883

Page.
Skim milk, fermented, for cows 86
food value 478
for calves and pigs 490
chickens, Ind 277
pigs, Mass. Hatch 570
from Swedish creameries, analyses 680
methods of testing 1085
pasteurized vs. raw for calves, Can 606
vs. whey for pigs 71
Sky, blue color 129, 823
U. S. D. A 222
Skylark, notes, U. S. D. A 421
Slag. (*See* Phosphatic slag.)
Slaughterhouses, municipal ownership 591
Slime molds of North America 515
"Slimy" bread, notes 882
Slippery callalu, analyses 249
Sludge, analyses, Mass. Hatch 1026
Slug, gray field 371
Slugs, remedies 658
Smallpox of potatoes 948
Smart, J. H., services to agricultural education 1001
***Smerinthus ocellatus*, notes** 767
Smoke and fumes, invisible injury by 910
Smut (*See also* Barley, Corn, Oats, Rye, Wheat.)
as cause of contagious abortion 495
spores, injury to animals 91
***Smynthurus fusca*, notes** 766
Snails affecting hops 476
Snapdragon, eradication, Wis 749
Snout beetle, imbricated, U. S. D. A 364
beetles, new group 767
Snow and rain gauge, Marvin's, U. S. D. A. 127
measurements, U. S. D. A 127
rollers, U. S. D. A 222
temperatures, U. S. D. A 222
"tornadoes," U. S. D. A 430
Snow fall and forests, U. S. D. A 221
Snow-on-the-mountain, notes, Okla 354
Soap as a disinfectant 998
mixtures and copper fungicides, combination 1060
Society for the Promotion of Agricultural Science, meeting 1099
Sociology and irrigation 195
Soda lime for determining carbon dioxid ... 213
substitution for potash 35
R. I 915
value as a fertilizer, R. I 914
Soda-water sirups, examination 970
Sodium carbonate. (*See also* Carbonate of soda.)
effects on animal body .. 962
chlorate, effect on cleavage of protein 483
chlorid solutions, measurement of osmotic pressure 419
determination 417
dioxid in studying the respiratory function 79
nitrate, studies 331
oxalate for standardizing solutions. 22
Sodium perchlorate content of sodium nitrate 528
in sodium nitrate, determination 110
rôle in plants 513
salts, acid, effect on *Lupinus albus*. 1100
Soil and rain, effect on forage plants 82
as affected by forest clearing and cultivation, U. S. D. A 127
bacillus resembling *Bacillus megatherium* 715
bacteria, distribution 218
effect on growth of typhus bacilli 393
studies 827, 917, 1099
between rows of castor beans, ash analyses, Okla 277
ferments, dissemination 227
oxidation of ammonia 212
grains, determination of effective diameter, Wis 524
importance in determining rate of flow of liquids 518
infusions, effect on the development of roots 623
moisture as affected by—
mulches, Wis 522
mulching and watering 649
salts 716
tillage, Can 625
Mich 40
Wis 520
moisture, conservation, Kans 432
determination, N. Dak 325
in relation to crops and climatic conditions 129
observations 228, 622
N. Dak 823
studies, Kans 498
study, geological significance 827
survey, method of making 623
tests, Mass Hatch 529
reliability, R. I 914
with oats, Conn. Storrs 836
transformation of nitrates 331
water, evaporation, Colo 324
N. Dak 326
studies of phosphoric acid 821
Soiling crops for cows 587
N. J 783
Soils, acid, liming, R. I 915
acidity, determination 1003
aeration 526
alkali, analyses 823
forage plants for, U. S. D. A ... 423
for sugar beets, U. S. D. A 296
of Montana 223
plants for, U. S. D. A 397
analyses 228, 314, 328, 526, 538, 718, 823, 824, 842, 916
Can 827
Mass. Hatch 528, 1026
Minn 1018
N. Dak 224, 226
Nebr 840
Nev 133

Page.

Soils, arid, physical and chemical peculiarities 717
artificial, changes of physical properties 604
as affected by cultivation 32
salt water 326
calcareous, use of ammoniacal fertilizers 330
chemistry 418
composition as related to color of daffodils 319
conservation of water in 916
correspondence of analyses and fertility 228
cultivated, determination of available phosphoric acid, Mass. Hatch 508
loss of plant food 134
cultivation and manuring as related to physical properties 805
culture, Campbell method, Colo 339
daily heat exchange 132
determination of available constituents 131
calcium carbonate 23
carbon dioxid 508
clay 903
moisture, Can 625
phosphoric acid 505, 507, 508
plant food, Minn 1019
salt content, U. S. D. A 325
soluble mineral matter 131
disinfection for anthrax 894
distribution and biological importance of furfuroids 818
effect on fat content of rape seed 141
propagation of smut, Ohio 257
structure of plants 515
exhaustion in Egypt 437
fertility and humates 228
humus 1099
as affected by fertilizers 331
wheat farming 1099
related to analysis.
determination 1022
maintenance 1036
studies 130
fertilizer constituents, assimilability 138
requirements 442
for artificial cultures 514
roses, analyses 625
humus content as affected by lime 824
improvement with velvet beans and cowpeas, Ala. College 232
inoculation experiments 318
Me 908
in Red River Valley, temperature and moisture, U. S. D. A 819
lime requirements 1003
management 134
marsh, as affected by animal manures 627
mechanical condition, effect on lettuce, Mass. Hatch 552

Page.

Soils, methods of analysis for citric acid extracts.
in France 112
studying, treatise 826
testing 1023
moistened, determination of heat evolution 1022
moisture content 130
moor, grasses for 43
of Westphalia 134
movement and retention of water, U. S. D. A 434
of water 228
new method of mechanical analysis, Wis 523
occurrence of barium 619
of Cape of Good Hope, analyses 328, 823, 824, 1022
Dorset, analyses 327
Essex, analyses 328
Hawaii, available fertility 507
Kongo, analyses 526
Lodi, studies 134
Minnesota, analyses 1021
Mississippi, capabilities, U.S.D.A. 397
texture 328
North German flat lands, studies 434
Oklahoma, studies 433
Pecos Valley, studies, U. S. D. A 912
Prussian flat lands, studies 435
Red River Valley, analyses, N. Dak. 226
Rhein-Hessen, analyses 826
Rhode Island, lime requirements 918
Russia, bibliography 32
Salt River Valley, analyses, Ariz. 213
São Paulo, analyses 916
Siberia, analyses 1022
optimum content of phosphoric acid 822
percentage of precipitation penetrating 517
phosphates as affected by acid solutions 131
phosphoric acid content 228
preparation for spring grain, Can 630
productiveness as affected by cultivation 643
related to climatic conditions 1022
science 434
solubility of phosphoric acid at different depths 822
soluble mineral matter, U. S. D. A 434
sterilization for hothouse pests 361
studies 130, 434
temperature 223, 434
N. Dak 823
U. S. D. A 325
Wyo 1022
temperature as affected by—
mulching and watering 649
temperature of water applied, Wis 541
temperature at different depths 819
treatise 133
treatment, Ohio 274
utilization of fertilizing constituents 228

Page.
Soils, water content 517
Solanin, notes 214
Solanum carolinense, notes, Iowa 651
  torreyi, notes, Okla 354
Solar eclipse of May 28, 1900, U. S. D. A 621
  halo, U. S. D. A 222
  radiation, effect on growth of plants 907
    studies 819
Solids in milk and butter, determination 905
Somatoplasm as affected by grafting 346
Soot, analyses, Mass. Hatch 1026
  of soft coal, analyses, Minn 821
"Sorbose bacteria," action on aldehydes 125
Sorbose, biochemic production 124
Sorghum, analyses, Minn 883
    Okla 277
  blading cane, Del 142
  blight, notes 465, 949
  determination of available sugar, Del 142
  improvement, U. S. D. A 296
  notes, Mich 1037
  sirup, manufacture, U. S. D. A 293
  varieties, Del 142
    Mich 43
    developed by the Division of Chemistry, U. S. D. A 319
Sorrel, notes, Vt 354
Sounds, measuring and photographing, U. S. D. A 430, 622
Soups, canned, analyses, Conn. State 769
South Carolina College, notes 298, 1000, 1098
  Station, financial statement 1096
    notes 298, 800, 1000, 1098
Sows and pigs at farrowing time, U. S. D. A 397
Sows' milk, distribution of galactase, Wis 580
Soy bean as a feeding stuff, U. S. D. A 397
  affected by nitrogenous fertilizers, Conn. Storrs 837
  culture, Kans 733, 927
    experiments, Can 833
  fodder, analyses, Conn. Storrs 882
    digestibility, Conn. Storrs 874
  forage, analyses, Can 873
  beans, analyses, Conn. Storrs 883
    N. J 777
Sparrow, chipping, feeding habits 712
  English notes 428
    U. S. D. A 426
Sparrows, tree 428
Spavin, notes 291
Spaying cows 789
  effect on milk production 86, 696
Spectrum, effect on coloration of plant tissues 907
  growth of silkworms 908
Spelt in Virginia 1037
  notes, N. Dak 332
  wheat, analyses, Minn 883
Spermophagus pectoralis, notes, U. S D. A 470
Spermophilus tridecemlineatus, fighting with bacteria 711
Sphaceloma ampelinum, causing grape anthracnose 861
  notes 59
Sphærella fragariæ, notes 261
Sphæritidæ, monograph 562
Sphærostilbe coccophila—
  for San José scale, Ala. College 1042
    Ill 654
    N. J 761
  notes, Ohio 268
Sphærotheca mali, notes 260
Sphinx catalpæ, notes, U. S. D. A 952
Spice by-products, analyses, Conn. State 769
Spices, detection of adulteration 510
  ground, analyses, Conn. State 769
  pure, analyses, Conn. State 769
Spider bites and "kissing bugs" 561
Spilosoma virginica, notes, U. S. D. A 471, 952
Spinach, fertilizer experiments, Mass. Hatch 543
  flea-beetle, notes, U. S. D. A 365
  notes, Ariz 850
  shading, N. J 739, 752
  spraying, N. J 752
Spiræa, glucosids and enzym in 715
Spirillum disease of geese, cause 589
Spirits, detection of caramel 312
  manual of analysis 618
Spiroptera strongylina, notes 697
Splenic fever bacillus, biology 92
  studies 193
Spore formation in *Dematium pullulans* 122, 322
Sporotrichum globuliferum, in combating insects 659
    thermal death point 422
  parasiticum, notes 357
Spray calendar 275, 478
  Mass. Hatch 174
  Mich 274
  N. C 659
  Ohio 274
Spraying apparatus—
  description and use 278
    Ill 258
    Me 262
    R. I 262
  improved forms, Wis 560
  new, U. S. D. A 259
  notes, Ill 654
  tests 959
    Conn. State 758
Spraying beans, N J 751
  cucumbers, N. Y. State 257, 270
  currants, Wis 150
  for apple scab, Ill 258
    codling moth, Ill 258
    leaf curl, Mich 252
    San José scale, N. J 760
    scale insects 274
    shot-hole effect on Prunus 757
    spring cankerworm, N. Y. State 171
  instructions 278
  manual 371
  melons, N. Y. State 270
  orchards 167
  pears 256
  peas, N. J 752

Page.
Spraying tomatoes, N. J 752
wild mustard 159
Spring water, analyses, Vt 328
Spruce aphis, notes 562
Douglas, in northern Oregon 456
European, analyses of seeds 111
composition of seeds 111
insects affecting, bibliography, W. Va 475
native, for avenue planting, Can ... 852
red rot, notes 759
Rocky Mountain, notes, Can 855
Spurry, notes, N. Dak 339
Squash bug, common, notes, U. S. D. A 363
horned, notes, Ga 864
U. S. D. A 363
ladybird, notes, Conn. State 762
U. S. D. A 362
seeds as affected by anesthetics 1056
vine borer, notes, Ga 864
U. S. D. A 363
Squashes, notes, Ariz 850
temperature for germination 1056
varieties, Can 631
S. Dak 51
Stable disinfection 591, 998
Stables for cows 489
illumination, effect on eye diseases . 893
Stall for cows 285
Standard cookery book 380
dairy feed, analyses, Conn. State .. 279
Standardization of solutions 22
Standardized saccharimeter 112
Starch, constitution 814
content of corn as affected by storing 293
potatoes as related to diseases 255
trees, variations 28
determination 417
digestion in plants 321
feed, analyses, Conn. State 279
formation and distribution in trees . 117
of furfurol from 619
nutritive value 771
refractive index of different kinds .. 511
saccharification 706, 715
Starling, notes, U. S. D. A 426
Stars, heat radiation, U. S. D. A 819
shooting, U. S. D. A 221
Starters, pure culture 87
Stassfurt salt deposits, formation 704
State control of contagious diseases 591
Stations. (*See* Experiment stations.)
Statistics, agricultural, of foreign trade, U. S. D. A ... 296
Great Britain . 296
meteorological, improvement, U. S. D. A 127
St. Augustine grass, notes, Ala. College ... 154
Steam at low pressure for greenhouses 155
plow in Finland 97
France 540
vs. animal power for cultivation 1030
Steel for framework of barn 294
track wagon roads, U. S. D. A 197, 498
Steers, dehorning, Okla 1070
digestion experiments, Kans 381
Okla 277
feeding experiments 480, 778, 876
Can .. 664, 874, 875, 876
Minn 175
Miss 1068
Okla 1069
Utah 663
grazing on corn and cowpeas, Ark .. 965
metabolism experiments 770
winter feeding, Minn 176
Stems of plants, absorption of solutions 815
Sterigmatocystis nigra, development as affected by deleterious agents 910
Sterility of cattle, causes 289
Sterilization for prevention of foul brood of bees, Mich 61
of dairy utensils 188
milk, studies 893
soil for hothouse pests 361
water by ozone 133, 328, 718
with formalin 469
Stichococcus bacillaris on greenhouse plants . 906
"Sticky" bread, cause, Wis 565
Stifle joint, chronic arthritis 191
Stilbum flavidum, notes 362
Still heads for fractional distillation 511
Stilton cheese, manufacture 285, 490
St. Lucie grass, notes, Ala. College 154
Stoat, notes, U. S. D. A 426
Stock and scion, reciprocal influence . 249, 345, 850
feeding as related to beet-sugar industry 535
in North Carolina 497
rational, N. C 488
food, analyses, Conn. State 279
plants poisonous to 1057
raising and dairying, manual 86
Stockmen, books for 999
Stocks for Montana, notes 251
hardiness in Iowa 252
modification of scion 152
of apple, influence on top 51
Stomaphis graffi, notes 657
Stomata as affected by vapors 115
observations 114
wax stopped 116
Stone fruits, food value, U. S. D. A 599
lime, valuation 528
splitting of peaches 252
Storage battery for electrical recording instruments, U. S. D. A 620
reservoirs 195
as affected by forests 1052
Storm centers in the Pacific, U. S. D. A 222
of June 28, 1897, in France 31
signals on Great Lakes, U. S. D A ... 127
Storms, cyclonic, U. S. D. A 429
local, following river valleys, U. S. D. A 620
Straw manure analyses 626
vs marsh hay for steers, Can 876
peat as litter 438
shavings as bedding 971
Strawberries, analyses 1046

Page.
Strawberries analyses, Idaho 313
anatomical differences, Mont. 247
culture experiments, Ohio 150
in pots 1049
effect of frost on different varieties, Mont 246
removing runners 247
evolution 52
fertilizer experiments 1039
Mass. Hatch 543
N. J 736
fertilizers for 744
hill vs. matted row culture, N. J 736
irrigation 1039
maintaining productiveness, Mont 246
manual 852
morphology, Wis 544
notes, S. C 1047
pollination experiments, Mont 1046
preservatives for exhibition purposes, Can 649
rapid propagation 448
relation of frost to crop, U. S. D. A 819
renewal of beds 154
varieties 251, 253, 352, 650
Ala. Canebrake 251
Can 547, 644, 844, 850
Mass Hatch 544
Mich 50, 153, 252, 931
Mont 1046
N. J 736
Ohio 150
Pa 452
Va 851
Wis 150
Strawberry crown borer, notes, Ky 170
leaf blight, notes 261
Colo 314
Ky 170
roller, remedies, N. J 761
spot, notes 759
raspberry, notes, Mass. Hatch 544
Mich 50, 252
Wis 150
Streams, measurement 195, 196
small, in landscape gardening 650
Street sweepings, analyses 625
Conn. State 719
Streets, effect of sprinkling on development of bacteria 287
Streptothrix capræ, n. sp 797
Strigidæ, feeding habits 425
Strongylus capillaris lung-worm disease of goats 191
strigosus affecting rabbits 712
Strychnin, effect on tetanus 192
Stubble, plowing under for diseases of cereals 175
Subearth ducts, construction 490
Subirrigation, effect on lettuce diseases, Mass. Hatch 552
for lettuce rot 261

Page.
Subirrigation of grapes by brush ditches 452
Subsoil plows, French 596
Subsoilers, draft, Mich 96
Subsoiling for cereals and root crops, Wyo. 1026
of cotton, Ala. College 139
on light sandy soil, Ark 244
Subterranean organs of Compositæ 121
Subwatering in greenhouses 50
radishes, Me 929
Sucrene-oil meal, analyses, Me 279
Sucrose determination 311
inversion by different acids 20
Sucrose, rotation as affected by temperature 311
Sugar, analyses, Minn .
as a nutrient 184
food 481, 777, 1075
U. S D. A 278
beet crop of Sweden 733
leaf scorch, N. Y. State 1058
spot and seed disease 468
treatment, N. Y. Cornell 163
pulp, ensiled, containing lactic-acid bacteria 714
nutritive value 1075
effect on butter 781
for cattle and sheep 587
Oreg 1085
ring scab, notes 1061
root rot, notes 163
treatment, N. Y. Cornell 163
scab, notes 861
N. Y Cornell 163
seed, analyses 1056
anatomy and physiology 321
distribution by U. S. Department of Agriculture 536
production 535
testing 1056
Utah vs. foreign, Colo 338
soils, analyses 538
tops, analyses 733
preservation 733
beets, analyses 241, 340, 536
Ala. Canebrake 241
Ariz 213, 236
Can 832
Colo 337, 339
Idaho 340
Ind 236
Kans 236, 927
Ky 314
Md 441
Mo 237
N. Dak 241
N. Mex 1035
N. Y. Cornell 238
N. Y. State 238
Ohio 142
S. Dak 143
Utah 441
Vt 313
Wis 143
W. Va 239

Page.

- Sugar beets, animal enemies 712
  - as affected by beet seed parasites 948
    - phosphoric fertilizers 540
  - attacked by *Phoma betæ* 166
  - bacterial disease 756, 859
  - cooperative experiments—
    - Ariz 239
    - Colo 339
    - Idaho 340
    - Kans 236
    - Mo 236
    - N. Y. Cornell 237
    - N. Y. State 238
    - Ohio 142
    - S. Dak 142
    - Utah 441
    - Wis 143
    - W. Va 239
  - cost of growing, Idaho 340
    - N. Y. Cornell 237
    - S. Dak 143
    - Wis 143
  - culture experiments 241, 443, 643
    - Ariz 833
    - Nebr 839
    - N. Y. Cornell 237
    - N. Y. State 238
    - in Arizona 236
      - Colorado 337
      - Indiana 236
      - South Dakota 44
      - Maryland 441
      - Michigan 842
      - Montana 537
      - Oregon 1034
  - depth of planting, Can 631
  - development 643
  - diseases 163, 468, 756, 859, 861, 1057, 1058, 1061
  - feeding value 80
  - fertilizer experiments 138, 337, 643, 734, 842, 843
    - Nebr 839
    - N. Y. Cornell 237
    - N. Y. State 238
    - Wis 144
    - W. Va 239
  - formation of sugar 321
  - function of furfuroids 321
  - grafting 334
  - in Chile 538
    - Italy 842
    - the United States 535
  - injurious animals 428
  - insects affecting 564, 1057
    - remedies 564
  - management 535
  - manuring on heavy soils 843
  - monograph 842
- Sugar beets, notes, S. C 1057
  - on alkali soils, U. S. D. A 236
    - marshy soil, Wis 144
  - phosphatic fertilizers for 38
  - planting at different distances 44
  - production of alcohol from 535
  - purchase by sugar content 843
  - root system, N. Dak 315
  - sampling and analysis, methods 311
  - seed tests, Nebr 839
  - storing in warm and cold rooms 638
  - time of planting, N. Mex 1035
  - transplanting, N. Mex 1035
  - varieties 443, 842
    - Can 631
    - Colo 337
    - Nebr 839
    - N. Mex 1035
    - N. Y. State 238
    - Okla 1036
    - Wis 143
  - vs. mangel-wurzels for cows, Can 688
  - yield as affected by light 443
- Sugar cane, affected by *Tylenchus scandens* 759
  - analyses, Ariz 218
  - bacterium 714
  - breeding 848
  - chemical development selection 343
  - constituents 146
  - culture 443, 1038
    - experiments 784
  - effect of arrowing or flowering on sugar content 146
  - fertilizer experiments 734, 840, 841
  - fertilizers for 241
  - grub pest, remedies 957
  - juice, abnormally high polarization 905
    - as affected by soil salts 146
  - leaves as a feeding stuff 883
  - plant lice 66
  - purchasing 146
  - scale lice, notes 476
  - seedlings, analyses 643
  - studies 443
  - tops, green, analyses 75
  - varieties 643, 840, 841
- Sugar, determination 306, 419
  - effect on muscle exhaustion 67, 1075
    - nitrogen assimilation of legumes 516
  - food value 576
  - formation from protein 1076
    - in beets 321
  - from egg albumen 23
  - in molasses feed, determination 311
    - nutrition of man and animals 79
    - production of energy 184
  - increase of consumption in the United States 535
  - industry and its requirements 296
  - invert, determination 213
  - maple, as affected by forest-tent caterpillar, N. H 269

Page.
Sugar maple sap, pressure and flow, Vt 318
phenylhydrazin test for 705
place in diet 1075
raw, for cows 885
reducing and invertible in cornstalks 904
rotatory power 112, 311
solutions, effect of subcutaneous injections 483
Sugars, behavior and effect in the body 971
of cornstalks 112
preparation in pure state and separation 905
reducing, in musts and wines, determination 509
Sulphate of ammonia. (*See also* Ammonium sulphate.)
analyses, Conn. State 719
La 39
N. J 830
R. I 917
Tex 438
Sulphate of potash—
analyses, Ky 314
La 39
Mass. Hatch 137 1026
N. J 830
and magnesia, analyses, Conn. State 719
Mass. Hatch 1026
Sulphur, absence in cotton-seed oil 619
analyses, Idaho 314
and lime dip 191
content of urine in judging disease 483
determination in organic substances 311, 813
dip, experiments 997
for grapevines 168
potato scab, Del 468
importance in plant growth 723
in organic substances, determination 813
Sulphuric acid, determination in presence of iron 705
effect on color of meat 279
preparation of standard solutions 310
to check fermentation of urine 229
Sumac, adulteration 22
analysis 22
Sun scald, notes 173
of chestnuts, notes 362
spots, U. S. D. A 429
relation to rainfall 31
Sunburn, notes, Ariz 254
Sunflowers, analyses of seed, Idaho 314
culture in Russia 644
history 454
notes, Can 833
Okla 354
varieties, Ala. Canebrake 251
Can 631
Sunlight, effect on plants 420
Sunshine measured by selenium, U. S. D. A. 222
Superphosphates, adulteration 104

Page.
Superphosphates, analyses, Conn. State 719
La 39
Mass. Hatch 138, 528, 1026
N. J 830
R. I 917
Tex 438
arsenic content 381
as preservative of barnyard manure 135, 829
determination 112
effect on sugar beets 540
nitrogenous and guano, analyses, Conn. State .. 719
Susliks, remedies 393, 711
Susserin for hog cholera 696, 895
Swainsonia galegifolia, poisonous to stock. 1057
Swedish turnips, club root, treatment 254
depth of planting, Can 631
fertilizer experiments. 838, 1027
for sheep 1071
varieties, Can 633
Sweet clover, yellow, for green manure, Ariz 833
corn, analyses, N. J 737
double cropping with beans, N. J 737
fertilizer experiments, N. J .. 446, 737
fodder, analyses, Conn. Storrs. 882
digestibility, Conn. Storrs 874
forcing, N. H 146
U. S. D. A 599
notes, Ariz 850
susceptibility of varieties to *Pseudomonas stewarti*, N. J 751
susceptibility of varieties to smut, N. J 751
varieties 442
Mich 230
peas in Canada 1019
varieties 454
potato diseases, treatment, Md 260
flea beetle, remedies, Md 62
plume moth, notes, Md 62
root borer, remedies, Md 62
rot, treatment, N. J 753
potatoes, fertilizer experiments, Ala Tuskegee 146
fertilizer experiments, N. J 446
Swine diseases in New York 402
infectious, in Massachusetts 1087
treatment 591
Del 189
fever in New Zealand 997
notes 190, 995
U. S. D. A 995
origin of infection 997
partial paralysis and crippling 997
plague and hog cholera, distinguishing 996
tuberculosis, differential diagnosis 1091
bacillus, description 402
retention of virulence in milk, U. S. D. A 979

Page.

Swine plague, differential diagnosis, U. S. D. A 985
etiological studies 797
experiments with blood serum 696
in Norway 693
notes 290, 793, 825
serum treatment 93
U. S. D. A 89
studies 93, 191, 589
subcutaneous inoculation 594
treatment, U. S. D. A 997
septicæmia, etiological studies 797
Swiss cattle, brown, notes, U. S. D A 983
Sycamore leaf spot, notes 759
leaves, transportation of plant food 910
Sycamores affected by *Glæosporium nervisequum* 759
Sylviculture, principles 1050
Symbiotes felis, bibliography 764
Symphytum asperrimum, notes, N. C 1032
Syngamus laryngeus, n. sp, description 92
Syntonine, determination in peptic digestion 971
Systena blanda, notes, U. S. D A 471
frontalis, notes, U. S. D. A 952
tæniata, notes, U. S. D. A 471
blanda, notes, U. S. D. A 952
Tachina rustica, parasite on silkworms 561
Tæniasis nodular, differential diagnosis, U. S D. A 986
Tænia cœnura in the calf 289
fimbriata, notes, Kans 498
Tæniidæ, classification 429
Tamarack, analyses, Idaho 314
Tan bark beetle, notes, U S D A 954
Tankage, analyses, Conn State 719
La 39
Mass. Hatch 528
Minn 831
N. J 830
R I 917
Tex 438
Tanymecus indicus affecting wheat 1062
Tapeworm, fringed, Kans 498
in sheep in Montana 1092
Tarred paper bands for insects 175
Tarsonemus ananas, n. sp, notes 257
Tartaric acid color reactions 510
inverting power on sucrose 20
Tea, adulteration, N. C 971
analyses 548
Conn. State 769
Idaho 314
as a food protector 970
blight, notes 469, 948
blights, treatment 172
bush, insects affecting 273
culture in South Carolina, U. S. D. A 741
southern India 452
manual 1048
factory, description, U. S. D. A 742
fertilizer experiments 1048
insects affecting 1062
Tea pest, new, notes [illegible]
pests, studies [illegible]
Telegraphy, weather, history, U. S. D. A [illegible]
Temperature as affected by forest clearing and cultivation, U. S. D. A 127
related to altitude [illegible]
at Baltimore, Md., U. S. D. A [illegible]
changes, effect on movements of ground water 517
effect on bees 271
cheese ripening 490
germination of seeds 156
respiration of plants 421, 515
rotation of sucrose 311
seeds 54, 855
forecasts, U. S. D. A 127
in Alaska, U. S. D. A 621
Nicaragua, U. S. D. A 430
sunshine, U. S. D. A 620
intermittent, effect on germination 856
low, effect on insects 562
minimum, on mountain peaks, U. S. D. A 621
new method of measuring 511
of insects 556
plants, notes 315
reports, telegraphing to section centers, U. S. D. A 127
sensible, U. S D. A 221
variations in free atmosphere 517
vertical gradations, U. S. D. A 222, 621
Tendons, constituents 1100
Tenebroides mauritanicus, notes, U. S. D. A. 952
Tennessee phosphate rock, analyses, La 39
Station, notes 99, 298, 490, 800, 899
University, notes 298, 899
Tent caterpillar—
American, notes, N H 169
destruction by birds, U. S. D. A 953
forest, destruction by birds, U. S. D. A. 953
notes, N. H 169, 269
predaceous enemies, N. Y. State 866
remedies, N. Y. Cornell 368
N Y. State 866
notes 370, 957, 1064
Can 657, 863
remedies 558
Teosinte analyses, Okla 277
Tephrites psidii, n. sp., notes 273
tryoni, notes 273, 558, 563, 870, 1065
Termes acanthothorax, n. sp 66
mülleri, n. sp 66
niger, n. sp 66
Termites, new, from Africa 66
Test papers, preparation and use 619
Tetanolysin, notes 694
Tetanus, differential diagnosis, U. S. D. A 985
etiology 694
notes 91
Del 189
poison, modification 288
remedies 288, 892
Va 190

Page.

- Tetanus, studies 192
  - toxin and antitoxin, combination in guinea pigs 288
  - virus, excretion by kidneys 995
- *Tetraneura ulmi*, notes 657
- *Tetranychus bioculatus*, notes 172
  - *telarius*, notes 174
- Texas College, notes 100, 298, 499, 800
  - fever, biology 796
    - control in North Carolina 593
    - dipping experiments 285
      - Okla 391
    - duration of immunity 1086
    - immunization experiments 1086
    - inheritance of immunity 1086
    - inoculation experiments 796
      - Okla. 391
      - U. S. D. A 991
    - investigations, Mo 988
    - notes 901, 995
      - Del 189
      - Nebr 393
      - Okla 1091
    - organism, differential diagnosis, U. S. D. A 985
    - regulations in Uruguay, U. S. D. A 997
    - studies 92, 192
    - ticks as affected by low temperatures 1087
      - method of acquiring virulence 1087
    - transmission by insects 995
    - treatment 494
  - Station, financial statement 1096
    - notes 99, 298, 499, 800
- Thebus irrigation commission, report 395
- Thein, effect on excretion of alkali in urine 778
- Thermometer holder 288
- Thermometers for dairies, Can 689
  - sluggishness, U. S. D. A 819
- Thermostats, thermoregulator 420
- Theses, abstracts, U. S. D. A 222
- Thistle, Canada, eradication 462
    - Wis 749
  - in New Zealand 858
  - Russian, disappearance 858
    - eradication, Wis 749
    - notes, Nebr 315
      - Wash 1055
  - sow, eradication, Wis 749
- Thomas slag. (*See* Phosphatic slag.)
- Thorictidæ, monograph 562
- *Thosea cervina* affecting tea 1062
  - *divergens* affecting tea 1062
- *Thrips cerealum*, remedies 959
  - *communis* affecting peas 1066
  - *physopus* affecting peas 1066
  - *tabaci*, notes, Mich 954
    - U. S. D. A 472, 952
- Thrush, black, notes, U. S. D. A 426
- Thunder, air currents in, U. S. D. A 620
  - predictions, U. S. D. A 429
- Thunderstorms, automatic records, U. S. D. A 620
- Thunderstorms, notes, U. S. D. A 819
  - of August 2, 1899, U. S. D. A 620
- *Thuya occidentalis elwangeriana*, notes, Can. 855
- *Thyridopteryx boisduvali*, notes 658
  - *ephemeræformis*, notes, U. S. D. A 952
  - *herrichii*, notes 658
  - *hubneri*, notes 658
- Thysanoptera, notes 370
- Tick fever in the southern English colonies 796
  - prevention 289, 695
  - of domestic fowls 291
- Ticks and "louping-ill" 593
  - notes 760
- Tillage, early vs. late spring, effect on soil moisture, Wis 520
  - effect on soil moisture, Mich 40
- *Tilletia caries*, notes 361
  - *corona*, notes, S. C 463
  - *fœtens*, notes, Ohio 161
  - *horrida*, notes, S. C 464
  - *lævis*, notes 361
  - *tritici*, notes, Ohio 161
- Tilletia, studies 1099
- Timber, Ceylon, mechanical tests 942
  - insects affecting 763
  - physics, work of the Division of Forestry 1050
  - tests of Prussian-grown woods 458
  - trees of Queensland 458
  - vulcanizing 1052
- Time, decimal notation 1076
  - standard, U. S. D. A 620
- Timothy, analyses, Conn. Storrs 882
    - Pa 436
  - breeding, notes 220
  - hay, analyses, Can 873
    - composition and fuel value, Mo 1076
  - notes, N. Dak 339
  - seed, viability 158
  - seeding, N. C 1032
- *Tinea granella*, notes 767
- Tineidæ, effect of leucocytes in metamorphosis 870
- Tipula affecting grasses 1066
- *Tipula pratensis* affecting cereals 1057
- Tissues, normal emulsified, toxicity 892
- Titmouse, great, notes, U. S. D. A 426
- Toadflax, eradication, Wis 749
- Toads, studies 429
- Toadstools, poisonous 121
- Tobacco as an insecticide 66
  - assimilation of soil chlorin 182
  - barn, use of artificial heat, Conn. State 730
  - barns, plans and specifications, U. S. D. A 726
  - bud worms, remedies, U. S. D. A 471
  - bug, new, remedies, U. S. D. A 471
  - "calico," disease, Conn. State 755
  - cigar-leaf, culture in Florida, U. S. D. A 726
    - curing and fermentation, U. S. D. A 727

Page.
Tobacco, cigar-leaf, temperature changes in fermentation U. S. D. A. 729
trade, requirements, U. S. D. A. 726
climate adapted to, U. S. D. A. 430
cost of production in Florida, U. S. D. A. 727
culture 448
experiments 839
Can 833
in Mexico 843
New Guinea 146
Russia 341
Spain 843
Tunis 444
West Indies 644
cutworms, notes, U. S. D. A. 472
decoction, preparation and use, Me. 262
determination of nicotin 22
dust, analyses, Mass. Hatch 138
effect on black peach aphis, Ohio 472
experiments in curing and fermenting, Conn. State 730
summary 540
extract by-product, analyses, Ky. 314
fermentation 341
in bulk, Conn. State. 730
fermented, efflorescence 515
fertilizer experiments 924
flea-beetle, notes, U. S. D. A. 365
remedies, U. S. D. A 471
growing under shade sheds, U. S. D. A. 727
horn worms, remedies, U. S. D. A. 471
industry in Chile 538
insects affecting 871
investigations in Russia. 45
leaf miner, notes, U. S. D. A. 472
quality as affected by fertilizers 924
light vs. heavy seed 644
loss of water in curing, Conn. State 730
mosaic disease, notes 362
Conn. State. 756
studies 167, 358, 359
native, as a weed in New Zealand 858
nematode, treatment 711
smoke, chemical studies 619
spot disease, Conn. State 756
"spotting," Conn. State 755
sprayed with arsenic, analyses, Ky 314
stalk worm, notes, U. S. D. A. 953
stems, analyses, Conn. State 719
thrips on carnations, remedies 1065
varieties 839
Can 833
Virginia, in Brazil 644
waste, analyses 627
worm, notes, Md. 62
wrapper leaf, in New England 927
"Toile" disease, studies 360
Tomato bacteriosis, notes 861
blight, treatment, N. J. 752
diseases, Mass. Hatch 552
downy mildew, prevention 259
Tomato, etymology [illegible]
hybrids, development [illegible]
Tomatoes, analyses, Minn [illegible]
double cropping with peas, N. J. 738
dwarf, culture 451
fertilizer experiments, Mass. Hatch 543
N. J. 445, 738
forcing 1039
grafting on peaches 850
irrigation experiments, N. J 738
liming, N. J 739
mulching, N. J 738
notes, Ariz 850
planting at different dates, N. J. 738
productiveness of early vs. late germinating seed, N. J. 738
pruning, Mass. Hatch 552
spraying experiments, N. J 752
thinning, Ark 243
transplanting, Ark 242
varieties 451
Ala. Canebrake 251
Can. 644, 845
Mich 250
N. J 738, 752
S. Dak 51
yields on old and new lands, N. J. 753
Tornado alarms unnecessary, U. S. D. A. 430
at New Richmond, Wis., U. S. D. A. 620
fake, U. S. D. A 620
hurricane, and cyclone, U. S. D. A. 620
its force, U. S. D. A 620
observations, U. S. D. A 620
phenomena, U. S. D. A 620
photographs, spurious, U. S. D. A. 430, 620
tracks, ancient, U. S. D. A. 620
Tornadoes, characteristics, U. S. D. A 429
notes, U. S. D. A 432, 819
prediction, U. S. D. A 429
protection against 821
Torrey nightshade, notes, Okla 354
Tortoise beetles, notes 273
remedies, Md 62
Tortrix ambiguella, remedies 871
dumetana, notes 766
glaphyriana, notes 173
paleana, notes 765
ribeana, notes 766
viridana, notes 766
Toxæmic hæmoglobinuria of cattle 894
Toxicology, compendium 112
of ricin 496
Toxin and antitoxin mixtures, properties 890
Toxins, constitution 890
effect in digestive canal 194
on plants 122
in urine, determination 23
Tropon residue for pigs 483
Trama radicis, notes 564
Transmission of growth characteristics 910
Transpiration of conifers and angiosperms. 116
plants 118, 221, 908
Transplanting as affected by early root growth, Wis 511

Page.

- [illegible]ediment 314
- [illegible]matism and tuberculosis 193
- [illegible]surer, report, Ariz 295
  - Conn. State 799
  - Kans 897
  - Me 998
  - Mont 1095
  - N. Mex 599
  - N. Y. Cornell 896
- Tree branches, lateral, cause of direction 319
  - canker, cultures 950
  - cuttings, distribution, Can 855
    - season for planting 51
  - planting, cooperative work, U. S. D. A. 745
    - experiments in Australia 1052
  - root rot, notes 469
  - sparrows, notes 428
  - trunks, chemical physiology 121
- Trees and shrubs at Canada Experimental Farm 942
  - as affected by lightning 1051, 1052
  - evergreen, hardy, in New England 747
  - for restoration of mountain forests 455
  - forest, as affected by climate, Va 455
    - cause of decay 458
    - stand as affected by light 458
  - formation and distribution of starch 118
  - frost injuries to 515
  - frozen, treatment, Mich 252
  - growth, as affected by distance of planting 455
  - gum flow 28
  - hardiness in the South and the North 1099
  - height growth in plantations 748
  - in cities, cause of destruction 458
  - leafing 221
  - moving without a wagon 454
  - new method of watering 50
  - of Michigan, adaptability and rate of growth 747
    - Wyoming, description, Wyo 53
  - ornamental, varieties 852
  - starch content 28
  - timber, of Queensland 458
  - winter condition of reserve food substances 117
    - injured, treatment, Kans 498
- *Trema aspera*, notes 220
- Tres Marias Islands, natural history, U. S. D. A 428
- *Tribolium confusum*, notes, U. S. D. A 952
- *Tribulus terrestris*, notes, Iowa 651
- Trichinæ, detection 290
  - infested pork, feeding experiments 797
- Trichina inspector, manual 594
- Trichinoscope, description
- *Trichobaris trinotata*, notes, Kans 171
- Trichodectes, notes 263
- *Trichosphæria sacchari*, affecting sugar cane 759
- *Trichosporium collæ*, causing mold of butter 683
- *Trifolium hybridum*. (*See* Clover, alsike.)
  - *incarnatum*. (*See* Clover, crimson.)
  - *pratense*. (*See* Clover, red.)
  - *repens*. (*See* Clover, white.)

Page.

- Trifolium seed, color variation in 1056
- *Tristania conferta*, notes 1052
  - *laurina*, notes 1052
  - *suaveolens*, notes 747
- *Triticum spelta* in Virginia 1037
- Tropical plants, animal and plant parasites 947
- Tropon as food 1075
  - residue for cows 86
- Truck farming in Florida 153
- Trucking in North Carolina 497
- *Trypeta acidusa*, notes 558
  - *ludens*, notes 558
  - *musæ*, n. sp 273
  - *pomonella*, notes 273
- Tsetse-fly disease, studies 92, 192, 592
- Tuber formation, physiology 710
- Tubercle bacilli growth on potato cultures 694
  - histogenesis 92
  - in beef, demonstration 794
    - butter 387
    - milk, experiments in killing 386
      - retention of virulence, U. S. D. A 980
    - oleomargarine 790
  - localization after inoculation into left ventricle 694
  - persistence in the nasal passages of the guinea pig 894
  - phagocytosis 193
  - studies 394
  - technique of preparation 794
  - thermal death point in milk 1091
  - bacillus group acid-proof bacteria of 694
- Tubercles root, of legumes 25
- Tuberculin, artificial 494
  - as a diagnostic 593, 795, 894
  - composition 791
  - determination of values 92
  - experiments 89, 92, 285
    - N. J 791
  - nature of effect on tuberculosis bacillus 92
  - period during which potency is maintained 89
  - preparation and use, U. S. D. A. 490
  - tests 193, 995, 1089, 1092
    - Can 894
    - Del 189
    - Me 987
    - Utah 1091
    - in Victoria 695
    - practical value 996
  - use 194
- *Tuberculina sbrozzii*, n. sp., notes 469
- Tuberculosis and swine plague, differential diagnosis 1091
  - as affected by soluble products of Streptothrix 795
- Tuberculosis bacilli—
  - analyses, U. S. D. A 996
  - fats, analyses, U. S. D. A 996
  - mineral constituents, U. S. D. A 996

Page.

Tuberculosis bacillus—
certain products, U. S. D. A. 987
immunizing properties of attenuated cultures, U. S. D. A. 988
new stain for, U. S. D. A. 996
Tuberculosis, bovine—
and meningitis 193
traumatism 193
variola 193
attitude of European science, Conn. Storrs 890
control 694
early stages, effect on milk 494
extermination 592
frequency, statistics 794
heredity and acquired susceptibility 1087
in Argentine Republic 694
Europe, Conn. Storrs 189
France 193
Massachusetts 590, 1087
New South Wales, U. S. D. A. 996
New Zealand 995
Norway 693
1899, bibliography 193
infection of the lymphatic system through milk 592
inoculation from encapsuled abscesses 1091
inspection 193
killing germs in milk, U. S. D. A. 999
lessening infection and spread 1091
manual 92
mixed infection 694, 794
new diagnostics 89
occurrence in different breeds 694
milk 588, 678, 679, 790
various species of animals 790
predisposing diseases 694
prevention 394
pulmonary, diagnosis 1091
reduction in various countries 996
regulations of Bosnia and Herzegovina 795
serotheraphy 592
serum of Maragliano for 996
treatment, U. S. D. A. 987
subcutaneous injections of artificial serum 194
susceptibility as affected by age, sex, and race 695
transmission 92, 288, 494, 694, 791
Ark 689
Conn. Storrs 189
by milk 889
treatise 494
treatment 795
Tuberculosis, human—
mortality from, Ohio 692
new treatment 1092
treatment, U. S. D. A. 996
Tuberculosis in asses 393
birds 794
calves 193
congenital 394
cats 794
cattle and pigs 995
dogs 794
Tuberculosis in fowls [illegible]
U. S. D. A. [illegible]
goats [illegible]
horses [illegible]
notes 91, 190, [illegible], [illegible]
Nebr [illegible]
Tuberculous animals, infection from urine and feces, Mich 1086
use of flesh 894
cows, feeding milk to calves, U. S. D. A. 999
infectiousness of the milk, Mich 1086
herd, breeding up nontuberculous herd, Wis 966
meat, disposition, Ohio 691
experiments 694
Tugrin fog dispeller, U. S. D. A. 221
"Tule fog," history, U. S. D. A. 819
Tulip scale, notes, Conn. State 762
remedies, N. J 762
soft scale, remedies 66
Tulips, history and classification 650
Tumbleweed, notes, Okla 354
"Tun twig borer," life history 1066
Tungsten, separation from molybdenum 813
Turf, analyses 157
Turkeys, breeds 972
Turnip aphis, notes 957
beetle, notes 562
black rot, notes, Vt 56
club root. (*See also* Cabbage club root.)
treatment 254, 555
N. J 750
Vt 56
disease, notes, Mich 58
heart rot, notes, N. J 751
leaf spot, notes, N. J 751
white rot, notes 1061
wild, eradication 858
Turnips, analyses 71
culture 241
experiments, Can 832
effect of fertilizers on feeding value 1072
on taste of milk 81
fall, varieties, Can 631, 633
fertilizer experiments 332, 646, 842
Can 833
Mass. Hatch 543
for sheep 1071, 1077
notes, Ariz 850
varieties 842
Ala. Canebrake 251
S. Dak 51
water absorption of seed 1056
winter, varieties 251
yields on old and new lands, N. J 753
Tussock moth, remedies 558
white-marked, notes, Ky 170
Twigs, winterkilling, Vt 343
Tylenchus devastatrix, notes 167, 259, 273, 429
hordei, notes 259

Page.

[illegible] *[illegible]*, notes........ [illegible], 428, 760, 968
Tympanitis caused by fungus-infested cornstalks.............. 592
wild mustard........ 592
Type vs. breed in cows........................ 86
Typhoid bacilli in oysters.................... 427
fever as related to the dairy industry, N. Dak...................... 817
Typhoons of the Orient, U. S. D. A........ 620
Typhus bacilli, growth as affected by coli bacilli........................... 393
fever, transmission by insects.... 995
formation of antagonistic substances to...................... 689
immunity of lymphatic glands to.. 995
Tyroglyphus ananas, n. sp., notes........... 257
Udder, anatomy and diseases.......... 593, 796
Umbelliferæ, parasitic Æcidia............ 167, 949
United States Department of Agriculture—appropriations for 1900–1901............ 1098
scientific aids........................ 1
Universities, meteorology in, U. S. D. A... 819
Urea, modified method of determining..... 813
Uredineæ, modification of characters...... 322
Urinary calculi of domesticated animals.. 592
Urine, human, analyses.................... 313
new method of analysis............. 23
nitrogen, loss in drying, Mo........ 1005
prevention of fermentation.......... 229
sulphur content in judging disease 483
Urocystis cepulæ, inoculation experiments, N. J.......................... 752
occulta, notes.................. 361
Uromyces aconiti, notes.................... 468
Ustilago bouteloua causing disease among horses, Okla.................... 1090
carbo, notes....................... 361
cynodontis, notes.............. 949
destruens, notes................ 361
dregeana, notes................ 949
maydis, notes.................. 361
oryzæ, identity.................. 949
paraguariensis, notes.......... 949
rabenhorstiana, attacking crab grass, N. J.................... 749
tritici, notes, Ohio.............. 161
virens, identity................. 949
Utah College, notes.................... 899, 1098
Station, financial statement...... 496, 1096
notes.............. 99, 299, 899, 1098
Vaccination for blackleg................ 192, 494
contagious pneumonia of horses.................... 394
splenic fever............... 193
Vaccine, distribution, U. S. D. A............ 992
virus, cultivation in calves........ 195
report of institution at Utrecht for cultivating... 195
Vaccinium canadense, notes, Me........... 931
corymbosum, notes, Me.......... 931
nigrum, notes, Me.............. 931
pennsylvanicum, notes, Me..... 931
Vaginitis of cows, cause.................. 289
treatment............... 192
Vaginula hedleyi, remedies................ 658
leydigi, remedies.................. 658

Page.

Vanessa antiopa, notes...................... 1100
N. H................. 169
U. S. D. A........... 952
Vanessa, second generation................ 766
Vanilla culture.......................... 452
in Mexico.................... 1048
Seychelles Islands, U. S. D. A.................. 51
bean, culture and uses............ 649
in Mexico, notes.......... 153, 251
pollination................ 251
drying.............................. 1048
greenhouse culture............... 1048
Vaporer moth, notes........................ 66
Vapors, effect on stomata.................. 115
Variola and tuberculosis.................. 193
Vedalia cardinalis, notes.................. 477
Vegetable alkaloids, constitution........... 619
industry in Australasia......... 547
oils, treaties..................... 482
physiology as applied to fruit-tree culture.................. 451
products, stored, insects affecting............................ 956
seeds, tests, Conn State......... 750
vs. animal food for poultry, N. Y. State.................... 76
Vegetables, canned, analyses, Conn. State.. 760
Chinese, notes............... 1047
culture, U. S D. A............ 250
fertilizer experiments, N. C.... 341
requirements......... 649
forcing in France............ 153
insect and fungus diseases.... 272
notes, Can.................... 850
Prussian varieties, Ala. Canebrake.................. 251
Vegetation as affected by weather.......... 31
chemistry of, U. S. D. A......... 620
denudation.................... 319
in mountain regions. 747
experiments with nitrogenous fertilizers, N J.................. 720
period as related to ocean temperature.................... 223
vernal, in arid regions........... 422
Vegetative organs as modified by grafting. 344
Velvet beans, analyses, La................. 231
Mass. Hatch.... 138, 1026
culture....................... 442
U. S. D. A............ 341
experiments, N. Dak 241
for soil improvement, Ala. College................... 232
notes, Mich..................... 1037
U. S. D. A............. 341
Ventilation, natural and artificial.......... 598
Venturia inæqualis on American fruit..... 655
Verbesina, studies......................... 121
Verminol, tests........................... 1057
Vermont Station, financial statement...... 397
notes.......................... 99
Vertigo, clinical study.................... 91
Vetch and oats, digestibility, Mass. Hatch. 566
hairy, analyses, Ala. College.......... 922
as a forage plant, Ala. College. 921

Page.

Vetch, hairy, culture experiments, N. Dak.. 339
sand, analyses, Minn 333
Pa 436
culture experiments, S. Dak... 44
N. Dak.. 339
spring, analyses, Pa 436
winter, as a cover crop 538
for green manuring, Mich. . 1037
Veterinarians, station, cooperation with local veterinarians, U. S. D. A. 998
State, list, U. S. D. A 998
Veterinary Congress, International, in Baden-Baden 493
division of the ministry of veterinary affairs of Russia, report 693
medicine, bibliography 195
myology, nomenclature 285
service in Bosnia and Herzegovina 794
Hungary, report .. 793
Norway 693
work of the experiment stations 301
Vichka seed, analyses 575
Vicia faba, chemical changes in germination 749
villosa for green manuring, Mich 1037
Vicia seeds, hydrocyanic acid in 748
Victor corn-and-oat feed, analyses 279
digestibility, Mass. Hatch 566
Vilmorin, H. L. de, bibliographical sketch . 201
Vinegar, adulteration, N. C 971
analyses 312
Conn. State 770
Idaho 314
Mo 1075
Vt 313
bacteria 715
detection of caramel 312
Vinegars, eudiometric method for determination of acidity 618
Vineyards, green manuring 452
replanting with American vines 450
Vinification, recent progress 294
Viola calaminaria, zinc content . 1013
Violet culture new method . 154
treatise 852
disease, new . 261
diseases, treatment, N. J 752
leaf spot, notes . 759
U. S. D. A 463
"mixture" as a fungicide 166
Violets, culture experiments, Mass. Hatch 552
giant, notes 353
greenhouse investigations, N. J 750
nematode disease, prevention 947
propagation 937
shading 454
trained in tree like form 155
wood fungus disease, prevention .. 947
Virginia College, notes 200, 299, 699, 1098
Station, notes 199, 299, 699, 900, 1098
Virus, absorption by the conjunctiva 697
Viticulture in Brazil 154
Viticulture in Cape Colony [illegible]
Russia [illegible]
the United States [illegible]
practical, manual [illegible]
Vitis amurensis, notes [illegible]
Volatile solvents, continuous extractors ... 511
Volcanic eruptions in Hawaii, U. S. D. A ... 620
Volutella ciliata, conidia formation 546
Wagon roads with steel tracks 197, 498
Wagons, broad vs. narrow tired, draft 1094
Mich. 96
Walking stick, notes 955
Walnut bacteriosis, treatment 261
black, grafting 1049
leaf blight, notes, Mass. Hatch. ... 552
Walnuts, culture 453
English, culture in Europe 453
grafting 1049
notes 1049
varieties 549
Warts, contagious origin 190
Washing fluid, analyses, Idaho 314
Washington College, notes 200, 1098
Station, financial statement 898, 998, 1096
notes 199, 1098
Wasps, anatomical studies 765
Water, analyses 314, 434
Ariz 213
Can 326
Idaho 314, 327
Ky 314
Mass. Hatch 525
N. C 328
N. Mex 1036
Okla 1022
Vt 313, 328
methods of recording ... 510
studies 312
and animal diseases, U. S. D. A 397
apparatus for distilling 313
preventing backward flow 619
bacteriological examinations, Del . 434
blast lamp, low pressure 420
cold vs warm, effect on plant growth, Wis 540
for plants, U. S. D. A 296
conservation, as affected by forests 718
in soils 916
content of butter 188, 789
soils and rocks 517
detection of nitrates .. 419
determination of alkalis 813
ammonia 112, 312
character by color. 111
nitrates 112
nitric acid 312, 705
nitrous acids 312
oxygen 213, 312
turbidity 312
distilled, as a beverage 970
effect on plant roots 321
duty, Colo 395
effect on structure of plants 515
examination, methods 482

Page

Water, examination, microscopic ... 133
nitric acid reaction ... 811
flow through rigid porous media ... 518
sand grains of different diameters, Wis ... 525
for retting flax, analyses, Minn ... 812
function in metabolism ... 184
hemlock poisoning, treatment, N. Dak ... 287
importance of right amount and distribution in crop production, Wis ... 537
in large quantities, effect on excretion of nitrogen ... 778
milk, determination ... 213
sirups, determination ... 905
soil movement ... 228
the Sahara ... 223
iron content ... 23
lifts, tests ... 197
mineral, analyses, Ky ... 314
movement and retention in soils, U. S. D. A ... 434
new slide for microscopical examination ... 313
of moors, determination of acidity ... 312
on the joints in cattle ... 289
oxygen content as affected by electricity ... 133
pumping for irrigating purposes ... 1094
rapid process of purifying ... 526
regulations for use ... 195
resources of Indiana ... 1094
New York ... 1094
right litigation, prevention ... 798
problems of Bear River, U. S. D. A ... 798
Bighorn Mountains ... 1094
rights in Russia ... 294
of the Missouri watershed, U. S. D. A ... 95
sea, analyses ... 314
secreting organs, anatomy ... 424
seepage, studies, Colo ... 394
silica standards for determination of turbidity ... 813
State and national control ... 597
sterilization by heat ... 826
ozone ... 133, 328, 718
storage in California ... 597
supply, Colo ... 394
as affected by forest clearing and cultivation, U. S. D. A ... 127
forests ... 940
engineering manual ... 798
of Rocky Mountains ... 912
surface, evaporation, Colo ... 823
tank, sterile, N. J ... 714
underground, as affected by forests ... 826
notes ... 819
of Nebraska ... 31
vapor pressure for, U. S. D. A ... 819
wheel, American type ... 395

Page.

Watering, effect on soil moisture and temperature ... 649
new method ... 50
Watermelon diseases, notes, Ohio ... 357
wilt disease, U. S. D. A ... 944
Watermelons, cross fertilizing, R. I ... 928
notes, S. C ... 1047
varieties, Ala. Canebrake ... 251
Waters of the salt lake of Urmi, analyses ... 434
Watershed of Lake Minnetonka, hydrology, U. S. D. A ... 221
Waterspouts at Key West, Fla., U. S. D. A ... 620
Wax moth of bees ... 266
stopping stomata ... 116
Waxes, apparatus for determining melting point ... 419
determination of melting point ... 312
Weasel, notes, U. S. D. A ... 426
Weather and conduct, U. S. D. A ... 620
crop service of Iowa, director, U. S. D. A ... 819
the dairy, U. S. D. A ... 620, 819
as related to fungi, N. J ... 754
plant diseases, Conn. State ... 758
topic of conversation, U. S. D. A ... 127
Bureau and ice business, U. S. D. A ... 222
the farmer, U. S. D. A ... 397
benefits to western Nebraska, U. S. D. A ... 127
compensation of persons while learning station duties, U. S. D. A ... 127
in Alaska, U. S. D. A ... 222
international cloud work, U. S. D. A ... 620
men as university lecturers, U. S. D. A ... 430, 620, 621
officials, convention, U. S. D. A ... 126, 621
duties and qualifications, U. S. D. A ... 128
of New York, report ... 430
promotion of relations, U. S. D. A ... 126
relation to Department of Agriculture, U. S. D. A ... 126
public, U. S. D. A ... 126
stations, as stations of instruction, U. S. D. A ... 127
charts, monthly for West Indies, U. S. D. A ... 222
cold, blessings, U. S. D. A ... 222
effect on crops ... 911
vegetation ... 81
forecast postal cards, U. S. D. A ... 127
forecasting, U. S. D. A ... 223
in Canada, U. S. D. A ... 429
popular, U. S. D. A ... 620
forecasts and maritime interests of Great Lakes, U. S. D. A ... 126
warnings, distribution, U. S. D. A ... 621

Page.
Weather forecasts, critical estimate, U. S. D. A ... 126
dissemination ... 1018
and utilization, U. S. D. A ... 126
distribution by mail, U. S. D. A. ... 127
for Washington, Oregon, and Idaho, U. S. D. A . 620
long range, practicability and utility, U. S. D. A ... 126, 127
on letter boxes, U. S. D. A ... 222, 620
people most benefited, U. S. D. A ... 126
wording, U. S. D. A.... 126
handbook ... 621
in August, on Pacific coast, U. S. D. A.
map and the public, U. S. D. A ... 127
daily, development, U.S.D.A 127
for New Mexico, U. S. D. A ... 222
of section reports, improvement, U. S. D. A ... 620
utility, U. S. D A ... 222
observers, voluntary, issue of instruments and flags to, U. S. D. A. 127
of Manila, U S. D. A ... 30
periodicity ... 516
predictions, U. S. D. A ... 222
in the fifteenth century ... 223
Review and high schools, U.S.D.A. 819
service of Jamaica, U. S. D. A ... 429
Maryland, U. S. D. A ... 819
Pacific coast, U.S.D.A .. 126
telegraphy, history, U. S. D. A ... 221
vs. climate U. S. D. A ... 222
warnings, coloring, U. S. D. A ... 126
for Atlantic and Gulf coasts, U. S. D. A 126
stock men, 48 hours in advance, U. S. D. A ... 126
transportation companies, U S. D. A. 126
wet, effect on parasitic fungi ... 469
Webworm, fall, notes ... 272
Nebr ... 370
N. H ... 169
Weed exterminator, Minn ... 812
law, Wis ... 749
seed, ground, analyses, Conn. State 719
seeds, notes, Nev ... 158
of clover and grass seeds ... 1054
Mich. 54
Weeds, destruction by birds, U. S. D. A ... 425
chemicals ... 355, 1057
in cities, U. S. D. A ... 462
notes, Kans ... 498
Me ... 909
Okla ... 1057
Weeds of alpine meadows and [illegible]
Iowa, notes ... [illegible]
Nevada ... [illegible]
New South Wales ... [illegible]
Oklahoma ... [illegible]
Vermont ... [illegible]
Wisconsin ... 749
relative aggressiveness, N. J ... [illegible]
Weighing tube, new ... [illegible]
Well water, analyses, Vt ... [illegible]
Wellman expedition, second, U. S. D. A ... 620
West Indian hurricane service, U. S. D. A .. 126
weather service, U. S. D. A.... 621
West Virginia Station, financial statement. [illegible]
notes.
Whale flesh meal, analyses ... 79
oil soap, as an insecticide ... 68
for San José scale ... 274, 880
Del ... 473
Ill ... 654
preparation and use ... 273
Wheat, American, in India ... 144
affected by *Tanymecus indicus* ... 1062
as a feeding stuff ... 1075
at Rothamsted in 1899 ... 732
black stem rust, U. S. D. A ... 463, 942
botanical characteristics in breeding, Minn ... 640
bran, analyses ... 381
Conn. State ... 279
Conn. Storrs ... 363
N. J ... 777
vs. rice bran for cows, N. C.... 1076
bread, "antispire" system of making ... 478
vs. rye bread ... 183
breeding ... 144, 1039
for Australia ... 217
resistance to rust 843
methods, Minn ... 639
brown rust, sources of infection ... 554
chemical changes in molding and sprouting ... 619, 1036
crop of 1899, U. S. D. A ... 698
culture experiments ... 42
Ariz ... 239
Can ... 612, 832
N. Dak ... 338
in Portugal ... 341
the future ... 341
ear cockle, treatment ... 759
experiments, Kans ... 496
farming, effect on soil fertility ... 1060
fertilizer experiments ... 42, 732, 842, 1036, 1038
Can ... 833
Ga ... 841
Ky ... 731
Va ... 925
fields, West and Northwest, yields. 1038
flour, adulteration ... 811
analyses, Conn. Storrs ... 777
proteids, Minn ... 872
for alimentary pastes ... 380, 1035
frozen, composition and feeding value, Utah ... 1075

Page.
germination as affected by altitude. 252
affected by nutrient solutions 780
affected by temperature 156
tests, Can 857
grain, studies 942
grasses, notes, U. S. D. A 423
growing in soils extracted with acid, Minn 1019
with flax 644
inoculation experiments 1016
insects injurious to 955
intensive culture 843
jointworm, remedies 558
kernel, histology 482
lands of Canada 644
soils, N. Dak 226
leaf rust, studies, U. S. D. A 463
limit of tolerance of sodium perchlorate 917
loose smut, Nebr 314
notes, Ohio 160
methods of irrigation, Ariz 834
microparasites 59
middlings, analyses 381
Conn. State 279
Me 971
midge, notes 558, 955, 1065
Can 862
milling qualities 242
oil, chemical studies 618
orange leaf rust, notes, U. S. D. A 943
origin of different kinds 241
resistance to frost 1038
respiration in germination 29
root system, N. Dak 215
rotation experiments 733
rust, cause, Minn 861
notes, Ohio 161
treatment 1061
scab, notes, Nebr 315
Ohio 161
screenings, analyses, Minn 888
seed selection, N Dak 331
seeding at different rates, N. Dak 332
smut, treatment 861, 1057
Ind 356
Ohio 162
smuts, notes, Nebr 314
Ohio 161
soft, composition 1075
spot disease, notes, Ohio 161
spring, broadcasting vs. drilling, Can 629
seed selection, Can 630
varieties, Can 628, 632
stem maggot, notes 955, 957
Can 862
N. Dak 264
sawfly, notes 955
Can 862
straw, nutritive value 73
productive value 771
supply of the world 444
temperatures for germination 1056

Page.
Wheat, testing by chemical methods 1100
tillering 724
varieties 42, 241, 341, 442, 540, 632
Ariz 834
Colo 329
Ky 731
Md 440
Mich 43, 1087
Minn 630
N. C 1022
N. Dak 331
Okla 1036
Pa 731
viability 158
vs. barley for pigs 69
rye bread 183
whole-wheat bread, dietetic value 672
water absorption of seed 1056
winter, biology 28
conversion to summer wheat 1088
varieties, Can 629, 632
Wheats, macaroni, in Australia 481
rust-resistant 444
U. S. D. A 463
Whey, analyses, Vt 318
vs. skim milk for pigs 71
White grubs affecting sugar beets 1057
remedies 174
Nile River, value to Egypt 826
rot, notes 173
Wiborgh phosphate 230
Wild-cherry leaves, poisoning by, U. S. D. A. 599
Willow aphis, remedies 558
basket culture experiments 458
destroying fungus, notes 467
trees, abnormal growths 556
Willows attacked by *Glœosporium salicis* .. 1061
Wind, amount of force utilized by windmills 129
and the rain gauge, U. S. D. A 819
breaks, effect on evaporation, Colo 324
direction, vertical gradients, U. S. D. A 621
effect on catch of rainfall, U. S. D. A 620, 818
force, as related to altitude 820
injuring grapes 59
resultant, calculation, U. S. D. A 621
vanes, U. S. D. A 127
velocity and force 432
Windmill, annual work 897
Windmills, amount of force of wind utilized 129
homemade, in Nebraska 896
irrigation experiments 195
Winds, local, not tornadoes, U. S. D. A. 620
researches on movement in France. 129
Wine, artificial coloring 294
ash, analyses 214
bitterness caused by ferments 715
detection of fluorin in 818
disorders, bacteria of 652
fermentation, study 126
fruit, filtration 157
Growers' Congress in Germany 698
making residue, feeding value 383

Page.
Wine making with wine yeasts and pure cultures 126
  mannitic fermentation 126
  manufacture 293
  micro-organisms as affected by antiseptics 126
  pasteurization 126
  quality as affected by irrigation of vines 745
  volatile acid content 23
  yeasts in wine making 126
Wineberry, Japan, notes, Mich 252
  Wis 150
Wines, alcohol content as affected by culture of the grape 648
  analyses, Idaho 314
  Ky 314
  as affected by different cuttings 1049
  determination of reducing sugars 509
  effervescent, manufacture 157
  eudiometric method for determination of acidity 618
  examination 970
  recent investigations 882
Winters, severe, benefits, U. S. D. A 222
Winthemia 4-pustulata, notes, Ohio 62
"Winton" disease, notes 995
Wireworms as affected by kainit, Ohio 472
  mustard dross 767
  notes 66, 955
  remedies 362
Wisconsin Station, financial statement 590
  notes 299, 900
  University, notes 299, 899
Witch grass, notes, Vt 354
Witches' broom of *Pinus sylvestris* 469
Woman's milk, galactase in, Wis 580
Wood ashes, analyses, Conn. State 719
  Ky 314
  Mass. Hatch 137, 527, 528, 1026
  for lawns, Mich 1047
  frequenting fungi, biology 516
  leopard moth, notes 564
  miners, notes 763
  seasoning by electricity 855
  tick, notes, La 588
  Va 173
Woodpeckers, notes 428
Woods, description and use 1050
  heating power of different kinds 854
Wool refuse, analyses, Mass. Hatch 528
Woolly aphis, attacking pear trees 476
  notes 760

Page.
Woolly aphis, notes, Ky [illegible]
  origin 174
  remedies 871
Worm diseases affecting American horses 191
Wounds in plants, healing 116
Wyoming Station, financial statement 1096
  notes 499
  University, notes 499
Xanthin bases in sugar cane 810
  formation and combustion 576
Xanthium strumarium, notes 858
Xenia of corn, studies 1916
Ximenia americana, parasitism 467
Xyleborus cryptographus, notes 564
  dispar, affecting elm trees, Conn. State 762
  fornicatus, notes 273
  perforans, notes 174
Xylina spp., notes, Can 863
Xylocrius agassizii, notes, Can 863
Xylotrechus quadrupes, affecting coffee 1060, 1065
Yams, culture in the West Indies, U. S. D. A 1047
Yeast, alcohol-producing enzym 123
  extract, proteolytic diastase 715
  fermentation without 715
Yeasts, alcohol, genetic relation to molds 125
  as affected by nitrogen 125
  in agricultural practice 125
  nutrition 715
  wine, pure cultures in wine making 126
Yellow fever, transmission by insects 995
Yew galls, notes 766
Yucca aloifolia, notes 220
  brevifolia, notes 220
  filamentosa, notes 220
  filifera, notes 220
  gloriosa, notes 220
Zaluzania, revision of genus 121
Zapus, revision, U. S. D. A 429
Zebra caterpillar, notes 955
  Conn. State 762
Zebras, breeding, U. S. D. A 972
  experiments with mares 1077
Zeugophora, estivation 656
Zeuzera æsculii, notes 564, 765
  coffeæ, affecting coffee 1065
Zinc, determination 618
  in soil, effect on plants 328
  sulphate for fractional precipitation of peptic digestion products 510
Zircons, analyses 230
Zoologist of England, report 765
Zoology, agricultural, text-book 427